BBC MICRO USER

Volume 1 No. 3
May 1983 £1

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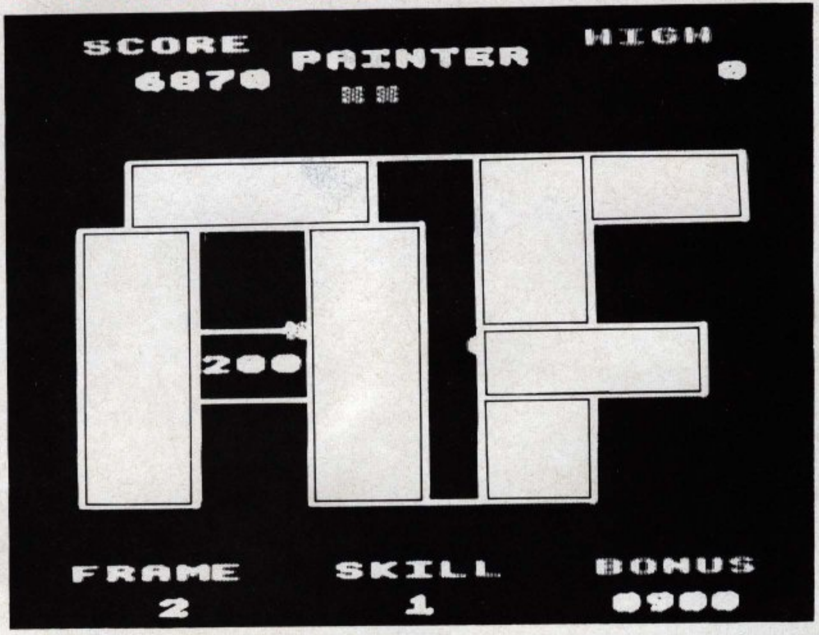

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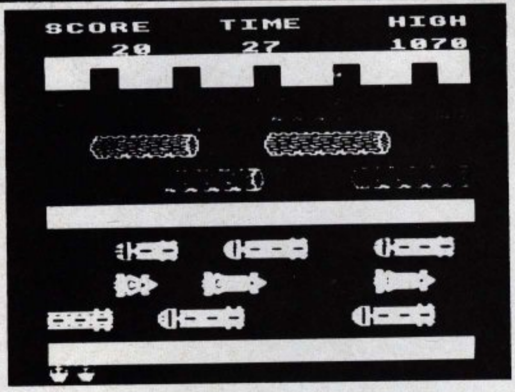

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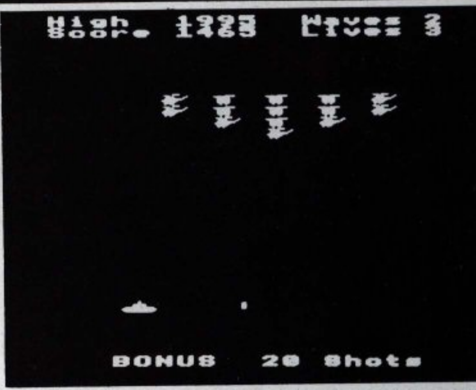

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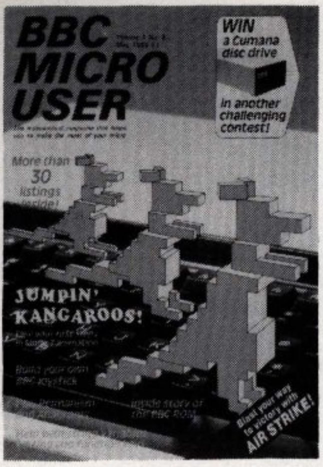
BBC MICRO USER
WIN a Cumana disc drive in another challenging contest!
More than 30 listings inside!
JUMPIN' KANGAROOS!
Blast your way to victory with AIR STRIKE!

Vol. 1 No. 3 May 1983

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Dragon 32k or 64k	●				●			●	
VIC20 (16k+)	●	●	●	●				●	●
Sinclair ZX81 (16k+)	●								
Grundy Newbrain	●								
Texas T199/4A	●								
Atari 400/800 or Osborne 1	●								
Sharp MZ80A	●	●	●	●				●	●
Sharp MZ80K	●	●	●	●				●	●
Sharp MZ80B	●	●	●	●				●	●
BBC micro model A or B 32K	●	●	●	●	●	●	●	●	●

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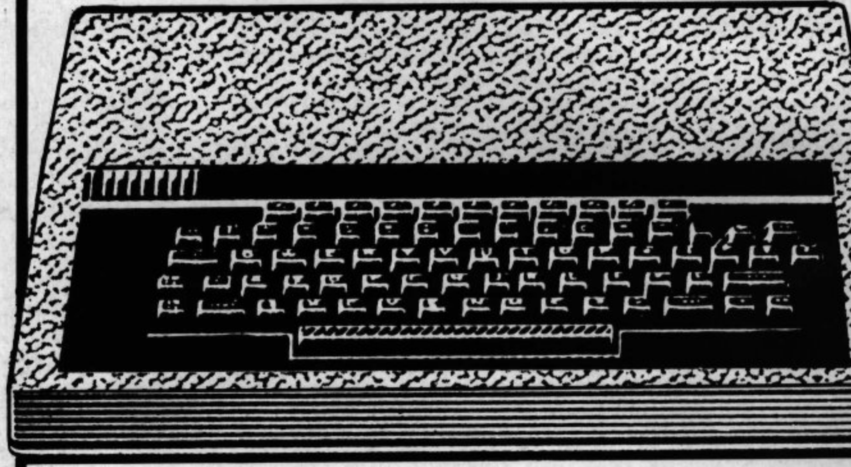

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BBC MICRO USER NEWS

May 1983

Down Under drive

ECONETS may be in short supply here, but the Australians have just installed their hundredth system.

The official launch of the BBC Micro in Australia was on St. Valentine's day. Since then, the discerning Australians have been snapping them up like hot cakes.

Not to be outdone, NBC, New Zealand's version of the BBC, has been showing the Micro program. Unlike the BBC, NBC are actually able to directly advertise the BBC Micro and are pushing it strongly.

MICRO PROGRAM COULD SAVE BBC TV THOUSANDS

A MAJOR breakthrough that could save BBC Television thousands of pounds in equipment costs has been made by BBC TV networks engineer Tim Kennington using a BBC Micro.

Kennington, 31, has written a program that enables the BBC Micro to be used as a terminal to create pages on the Ceefax service.

If current tests with the program are successful BBC TV outside broadcast teams will use micros to transmit Ceefax pages direct from live events. The first major trial is this month at the Sheffield snooker championships.

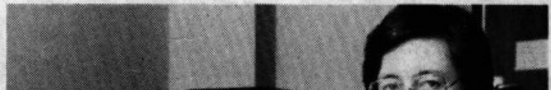
The BBC newsroom that prepares existing Ceefax pages currently uses Aston intelligent terminals linked to a PDP11 mini computer.

Each terminal costs several thousand pounds, but with Kennington's program a BBC Micro, costing only £399, can do the same job.

"We won't replace the existing newsroom terminals," said a BBC spokesman, "but for future developments the price and the portability of the micro has tremendous advantages."

"With it our staff could also work from home if necessary and either send the completed pages by telephone to the Ceefax computer or bring them in to Television Centre on a floppy disc.

"It could also be used in BBC newsrooms and production offices wanting to contribute to Ceefax."



Tim Kennington . . a breakthrough

Room for 16 ROMs

STEALING a march on Acorn is Watford Electronics which has produced a carrier-board to give the BBC Micro a 16 ROM socket capability.

The board has 13 ROM sockets. It plugs into one of the four sockets currently available on the BBC Micro to give a total of 16.

Watford Electronics is to produce the board itself, and managing director Nazir Jessa says it will be available from the end of this month for £19.95.

BBC users plump for Micronet

MORE than 1,000 people joined Micronet 800, the Prestel-based information and software database service, in the first month of its operation.

All the subscribers are BBC Micro users.

Managing director Richard Hease said that even though Micronet 800 was a revolutionary service bound to interest micro users, the response was still beyond initial expectations.

The first person to register was Surrey estate agent Jeremy Dredge.

He had heard about the proposed service last December and immediately sold his Vic 20, which he'd been using for three months, and bought the BBC machine.

Hunch

"I felt that because the BBC was so expandable it was likely to be one of the first micros to be connected to Micronet 800. It proved to be a lucky hunch."

He said Micronet 800 was enormous fun to use and easy to follow.

MICRO MARATHON PLANNED

THE most ambitious TV programme on the micro ever attempted is now being planned by the BBC's Computer Literacy team.

Called "Making the Most of Your Micro – Live", it will start at 11am on Sunday, October 2, and last for two hours. It will be presented by Ian McNaught-Davis, who also hosted the recently-ended TV series.

Invited

Readers of BBC Micro User are being asked to play an active part in helping decide what goes into the programme, and a number of them will be invited to be in the studio audience.

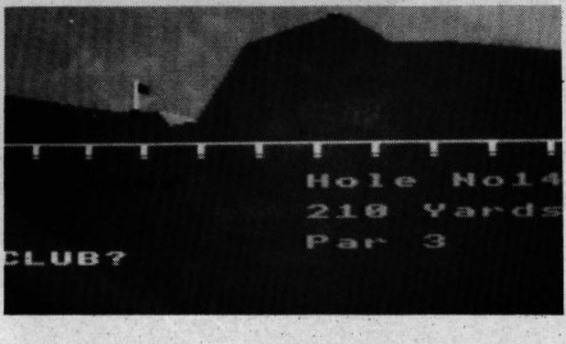
Anyone who would like to participate is asked to fill in and return the form on Page 11.

"At this stage we are very flexible about the structure of the programme", said director Patrick Titley. "The studio audience will consist of both experts and users, and Mac will invite them to join in the discussions and demonstrations.

"There will be filmed

Turn to Page 11

Exit violence, enter golf



Hole No14
210 Yards
Par 3
CLUB?

A NOVEL approach to the standard violence in arcade games has been taken by Squirrel Software.

"With our games we've deliberately moved away from the murderous aspect of 'zap and kill'," said a spokesman. Their first offering is Supergolf, in which the flight of the golf-ball is faithfully reproduced depending on which club a player chooses. For example, you can control backspin using a sand-iron.

And with another program, Bunfight, a player's reactions, concentration, timing and rhythm are all severely tested in trying to cope with two jobs at the same time on the icebun production line.

Softly, softly June launch for Electron

ACORN'S new micro, the Electron, will start going out to dealers in June, but only in limited quantities. According to joint managing director Chris Curry: "It's going to be a very shallow start-up, to spot any trouble before the problem gets too big.

"It will not be available in large quantities until October."

One interesting development is that the keyboard features single key entry of Basic keywords – a clear sign that it is aimed at the Spectrum market.

However, keywords can still be spelled out in the usual way. Despite these changes, the Basic and operating system are said to be much the same as in the BBC Micro.

The cost of the micro is expected to be around £150. For this you get a computer with 32k of RAM which will support all of the BBC Micro's modes except No. 7, the teletext mode.

This basic version can be expanded so as to have all the facilities of the full BBC Micro. Add on units will include Econet, teletext, games paddles, RS423 and parallel printer interfaces and a disc interface.

The fully expanded version will cost "a fraction more" than its equivalent, the model B.

The pre-production Electron shown to BBC Micro User is very similar in style to the BBC Micro, though somewhat smaller and more elegant.

The full size keyboard lacks specific user-defined keys and features an altered layout.

Function keys can be obtained by "shifting" the letter keys, which also bear the legends of the Basic keywords for single key entry.

The keyboard can also be fully "exploded", allowing the user to completely redefine each key.

Advanced

The Electron comes with an internal switched mode power supply. The isolating transformer is, however, built into the mains plug.

"I won't open it up," said Curry. "The thing's so advanced there are only a couple of chips in it."

Sackcloth section

The distributors of the Kaga monitor, reviewed last month, have pointed out that the model we reviewed was aligned for the Apple.

Had it been set up for the BBC Micro as it should, there would have been no clipping of the lines at the top and bottom of the screen. We regret the error.

60s are a good age to get into micros

AN old hand on a young machine is Bill Heywood who is probably the oldest, as well as one of the most enthusiastic BBC Micro dealers in the country.

Bill is 68. He's sold about 60 BBC Micros since taking on the machine late last year and is waiting for business to slacken off a bit so that he can start developing some music software for it.

"The problem with computers," he said, "is there is so much to learn.

"We are going into it properly – not just playing with it – and are learning more each day."

His company, Almaine, is in Colne on the north eastern border of Lancashire. Its name is a spin off from the 1930s. Says Bill: "It was a bit of a snob effort at the time, with everyone converting their battery powered radios to run on mains supplies."

He has handled TV sales and repairs since 1946 and decided to move into the micro market two years ago, selling the Acorn Atom. Taking on the BBC Micro was a natural progression.

Bill and his two partners, Noel Finucane, 31, and Mike Speak, 23, also sell BBC Micro software and carry out their own repairs.

Bill has no thoughts of retirement – he says he wouldn't know what to do with his spare time. "I'm younger and fitter than people half my age," he claims, "and haven't had half a day off sick in 54 years."

Now
CAL

... a probe opens into for training nurses

A THREE year project to investigate the use of micros to train nurses has been launched by the West Lambeth Health Authority's Nightingale School of Nursing in London.

Two BBC Micros are to be used in the project which is funded jointly by the Health Authority and the DHSS.

Project leader is Susan Norman, a senior nursing tutor, who will be working closely with programmers at the University of Surrey.

Their first aim is to assess the effectiveness of computer aided learning in nursing education for both trained and novice nurses. If that proves successful they will develop software for practical use.

"It will be difficult to assess the actual role played by CAL because it won't simply replace other methods of learning," said Miss Janice Cackett, director of nursing education at the school.

"We will want to see first whether we can write a program that people will actually use – and obviously we will be drawing on the experience of CAL gained in other teaching fields."

She said a wide range of micros was assessed before choosing the BBC machine for the project.

"We liked it because it was very easily available, robust and easy to use. Other packages being developed on the machine for use in schools could well be adapted for nursing, and we felt that people might have had more contact with the BBC Micro than with other machines."

Two-in-one TV

USERS can upgrade from black and white computing as well as black and white television all in one go with a new monitor/TV from Electronequip.

The 14in colour portable monitor/TV is not a modified television – it has been designed to perform both functions.

The makers claim it has better resolution than normal TVs and many 80 column monitors. The standard model is supplied with an RGB cable which plugs into the back of the BBC Micro and has composite video and sound input capabilities. It costs £244.95.

School micro meet

UNHERALDED amid the proliferation of software and hardware for the BBC Micro is a growth of interesting acronymns.

The latest is NAMEBUG, for the North and Mid-Essex BBC Micro User Group.

The group meets on the second Thursday of each month at a comprehensive school in Witham and membership is open to anyone with an interest in micros, regardless of whether they actually own a machine.

Meetings involve a program of talks and demonstrations by local dealers, followed by a general forum.

Workshop evenings for members interested in modifications, upgrades and interfacing are also planned.

For more information, telephone Dave Watts (0245 358127) or Andy Purkiss (0376 515609) after 7pm.

THE BBC MICRO MARATHON

From Page 9

stories about unusual applications, and during the two hours we will attempt to answer as many questions as we can, both from viewers who phone in and those sent in writing.

"We won't be able to reply to everyone who writes in, but we will read what they have to say very carefully and this will help us decide what goes into the programme."

This micro marathon will be followed by weekly repeats of "Making the Most of the Micro".

Also in the BBC pipeline are two more series – "The Electronic Office", about computers in business, and "Computers and Control", covering their use in industry. They will be shown in 1984.

READERS of *BBC Micro User* who would like to be in the studio audience for the transmission of "Make the Most of Your Micro – Live", or who have questions about microcomputing they would like to see answered on the programme, should complete this form and post it to:

Micro Special
BBC
PO Box 7
London W3 6XJ

Name ....

Address ....

....

....

Daytime phone no ....

☐ I would like the programme to discuss the following subject/s:

....

....

....

☐ I would like some advice on the following:

....

....

☐ I would like to be considered as a member of your studio audience

I own a BBC Micro YES ☐ NO ☐

Packing it in . . .

A PURPOSE-designed stand for the BBC Micro is claimed by manufacturers Zygon Products to pack maximum units into minimum area.

Space on the top shelf is provided for TV or monitor and for the cassette recorder or disc drives. The BBC Micro itself sits on the lower shelf which, when not in use, can be slid back to protect it.

It costs £59.

Americans get full treatment

THE American version of the BBC Micro will be an all-singing, if not quite dancing, fully-expanded model B.

On board as standard will be disc and Econet interfaces, the speech synthesiser and View, the Acornsoft word processor. The ensemble will sell for $995.

Despite the fact that Acorn has a large – and very expensive – publicity drive currently underway in the States, the machine itself will not go onto the market there until the end of June.

Apparently the BBC Micro has yet to be approved by the appropriate Federal Commission. Also the dealer network has still to be finalised.

Pricing

One thing that is certain is that the "super B" version would not be available in Britain – it's export only.

Acorn is also experiencing pricing problems on the export side. It seems some of its dealers are already rather naughtily exporting BBC Micros at a price that undercuts that of the official export product.

"That, and the falling pound, are giving us some headaches," said an Acorn spokesman.

BBC Micro roadshow takes to the buses

THE BBC Micro has taken to the buses in the North West of England. Eleven micros are installed on a double decker bus as part of Salford University's micro roadshow.

It visits schools and colleges in the region to provide on-the-spot training, demonstrations and advice, and a second bus is to be commissioned this month.

"In four or five years' time, everyone will be sitting down at computers and using the keyboard," said Roger Ross of CAMPUS, the campaign for the promotion of the university of Salford.

"We want to show everyone, from the early primary school to the sixth form, what computers can do."

Mr Ross said the roadshow had already been a tremendous benefit to schools.

"One high school was having difficulty keeping abreast of the latest technology.

"However, their headmaster was so impressed with what he saw on the bus that he's now planning to put more money into computer studies to develop the potential."

Dubbed Mobec (for mobile education centre) the bus has exhibition and demonstration space on the lower deck and a study/lecture lounge upstairs.

BUG BYTE'S MAIL MOVE

THE mail order activities of the Liverpool software house Bug Byte have been taken over by a new company, Software Express.

It will sell the company's games for the BBC Micro from a Freepost address, providing post and packaging free. There are 10 titles at present.

A spokesman for Software Express said the company will measure the response to the Bug Byte games before deciding whether to start developing its own software, or to take on the products of other software developers.

BARRY WOOD'S TAILPIECE

SO "Making the Most of Your Micro" has ended – and I, for one, have managed to control my grief.

The series had all the entertainment value of the Eurovision Song Contest but none of its intellectual depth.

My star moment was when John Coll was asked about a data transfer. The conversation went like this:

"How fast does it go?" enquired straight man McNaught Davis.

"Very fast", came the informative reply.

Making the most of the micro? Blue Peter could have made more of it!

* * *

ONE of Acornsoft's mandarins came close to apoplexy the other day. The occasion was the wining and dining of a pair of their potential authors.

One of the duo casually remarked that he'd never seen an original Acornsoft disc or cassette.

"Oh they're very good", the mandarin assured him.

"I know", came the reply. "I've got all the programs. So's everyone else I know. It's just that I've never seen an original."

* * *

IT could have been nasty, very nasty indeed. Imagine the red faces at Acorn if the cost of a new Electron plus the cost of its upgrading to full BBC Micro status came to less than that of a brand new model B.

After all, Acorn won't be paying their tithe to the BBC on this one, which allows for some flexibility in the costings.

And, of course, that terribly clever new technology must make for lower overheads. Pricing must have been an absolute nightmare!

As it is, the cost of the totally upgraded Electron comes to "a fraction more" than that of a new model B. Lucky for Acorn, that.

* * *

THOSE terribly nice people at Acorn seem to be getting themselves into all sorts of trouble predicting the release dates for their various items of new kit.

So I'm providing them, free of charge, a computer program that will do the job for them with, I'm certain, the same degree of accuracy:

```
10 DATA January,
   February, March,
   April, May, June
20 DATA, July,
   August, September,
   October, November,
   December
30 DIM A$ (12)
40 FOR I = 1 to 12:
   READ A$ (I) :
   NEXT I
50 INPUT "Item",item
60 P. item "will be
   available in ";
70 P. A$ (RND(12))
```

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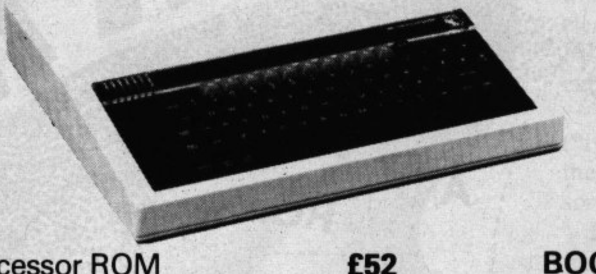

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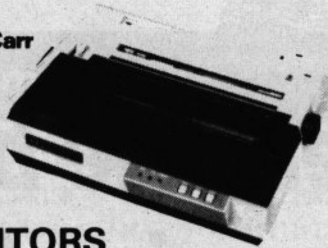

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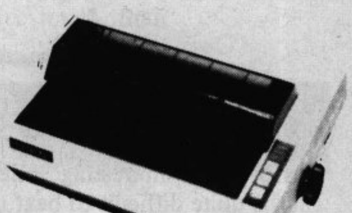

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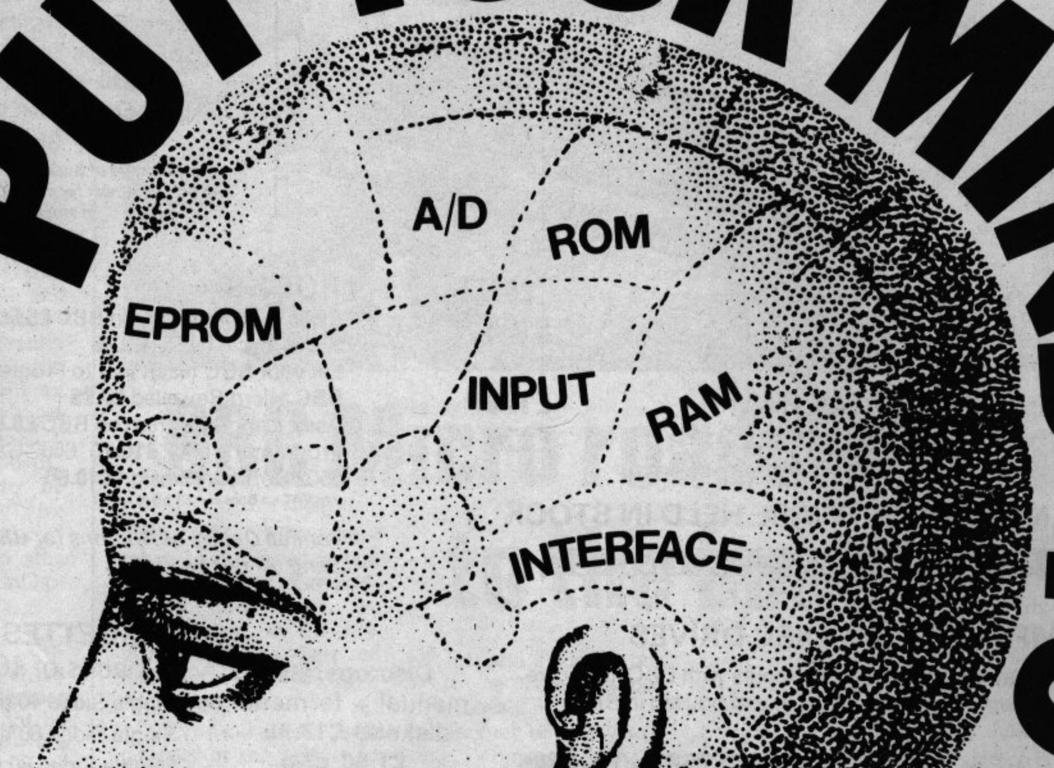


– and clear the board at Pelmanism!

THIS is an interesting little program that is quite difficult to beat unless you really concentrate. It is based on the original card game of Pelmanism or Pairs, the idea being to shuffle the pack and lay the cards face down on the table, then in turn to view any two cards and make pairs.

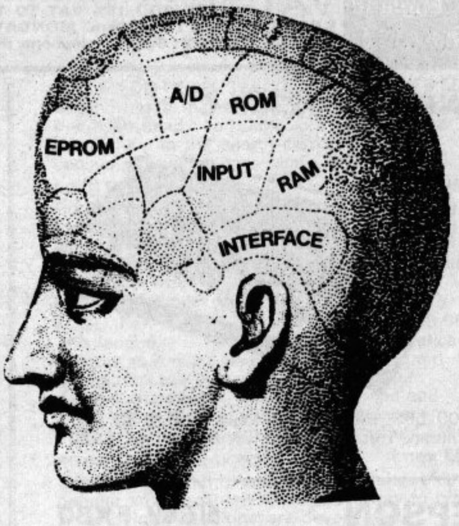
Where the cards are different they are replaced face down again – and the trick is to remember where they are situated.

The first thing to be done was to decide on a simple uncluttered screen format, then to design the 20 pairs of options to fit the matrix. The VDU23 statement on the BBC Micro is suitable for this purpose.

The game difficulty is ensured by shuffling the pictures into different sequences. The array A% is used to hold the card type from one to 20 at each position (one to 40) on the table. The shuffling is performed by exchanging each entry in the A% array with another random entry.

The degree of difficulty has been designed to allow a simple level 1 up to almost unbeatable level 6. This works on the principle that the previous number of moves will be remembered, by storing them in memory in the array M%. There is, of course no limit to the number of previous moves the computer's opponent may remember! The higher the degree of difficulty, the more previous moves the computer will remember.

The computer's play is straight forward. Where a pair has been displayed but no match found a record of the cards is stored from both the



By BRIAN and MARIAN CLARK

computer's and the player's go. A search is done to find a pair from the cards stored in memory. When a match is found the cards are removed from the memory store and a point scored.

If there is no match in memory, the computer selects a random card, which it will again try and match with its store of played cards, and only when a match is still not found will it choose a second random card.

The code has been written in a structured manner and a brief description of some of the points of interest follows.

Always set mode at the start to ensure you have control of everything that goes onto the screen *(line 40)*. This can avoid loading into an unsuitable mode after running something else, and presenting unpredictable results on the screen.

The main procedures are:

PROCVBLE: used only once at the start to set up the DIM statements and initial variables used throughout the game *(line 1490)*.

PROCINIT: contains the initial values required to be set or reset at the start of each game *(line 1290)*.

PROCTITLE: this important procedure is executed first as it does such things as provide a short description and a full list of the control keys and the space bar, required to successfully run and play the program *(line 1560)*.

It is important, even when short of space, to include instructions with the code to avoid loss and wasted effort. There must be many programs lying around on tapes where the writer cannot remember quite what they were but knows that they work good and should not be overwritten!

PROCENDGAME: deals with displaying the score, establishing who won and who lost. The procedure also includes a loop waiting for the space bar to be depressed to continue with the next game. It is better to wait for a particular key as this traps the inadvertent pressing of any key during play and missing the end game *(line 760)*. The program can then go back through **PROCINIT** for another game.

PROCPLAY: contains the guts of the program. It is advisable to keep the code as high level as possible by calling other procedures that contain the detailed processing. This is to simplify error trapping *(line 80)*.

It is much neater to switch the cursor off when it is not being used and on again when awaiting input from the keyboard. **(PROCON/PROCOFF** *lines 890,900). Line 100* performs a clear the input buffer (*FX15,1) just before accepting an input, to clear any extra key depressions during play.

The control keys are disabled (*FX4,1 *line 1500)* so that during input the cursor cannot float all over the screen.

It is always worth checking that the replies from the keyboard are valid within the context of the program. If a mistake is made on input the program must be able to cope. In this program the function VETERR *(line 210)* has been used which will return the value true if the input is not acceptable, i.e. outside the range A0 to D9.

If the input is invalid the use of TAB in the input statement ensures the question is repeated in the same place on the screen. Failure to do this could end up with the screen scrolling in the middle of the game. After input the cursor is switched off, but the input remains on the screen until the next input is prompted, when the whole input area is cleared.

A standard output routine is often useful, in this case **PROCPRT** *(line 290)* not only calculates the print position but also generates the graphic character required.

If escape is pressed, whether by accident or design, it presents the title page by using the on error routine *(line 40)*. A nice touch, that.

Pelmanism listing

```
   10REM *****************************
         *         PELMANISM          *
         * Brian and Marian Clark     *
         *      Copyright (C) 1983    *
         *****************************
   20PROCVBLE
   30ON ERROR GOTO1780
   40MODE7:PROCTITLE:IF PIC MODE5:PROCPI
C
   50REPEAT MODE5:PROCINIT
   60REPEAT PROCPLAY: UNTIL ENDGAME
   70UNTIL0
   80DEFPROCPLAY
   90FOR I%=24TO28:PRINTTAB(0,I%)SPC(20)
;:NEXT
  100PROCON:*FX15,1
  110INPUTTAB(0,24)"1st Choice e.g.A1?"B
$:IF FNVETERR GOTO90
  120A%=254:B%=253:PROCPRT:P1%=P%:X1%=X%
:Y1%=Y%
  130PROCON
  140INPUTTAB(0,27)"2nd Choice      ?"B
$:IF FNVETERR GOTO140
  150IF P%=P1% GOTO140
  160A%=252:B%=251:PROCPRT:P2%=P%:X2%=X%
:Y2%=Y%:T%=1
  170PROCCL:IF CT%(1)+CT%(2)=20 PROCENDG
AME:ENDPROC
  180PROCCMP:IF CT%(1)+CT%(2)=20 PROCEND
GAME
  190ENDPROC
  200REM VALIDATE INPUT CARD POSITION
  210DEFFNVETERR
  220IF LEFT$(B$,1)<"A" OR LEFT$(B$,1)>"
D" THEN:=TRUE
  230IF MID$(B$,2,1)<"0" OR MID$(B$,2,1)
>"9" THEN:=TRUE
  240I%=VAL(MID$(B$,2,1))
  250J%=ASC(LEFT$(B$,1))-64:P%=10*(J%-1)
+1+I%
  260IF A%(P%)=0 THEN:=TRUE
  270=FALSE
  280REM DISPLY CARD
  290DEFPROCPRT
  300PROCOFF
  310Z%=A%(P%):Y%=4+J%*3:X%=I%*2+1:PROCC
HAR
  320COLOURC1%(Z%):COLOURC%(Z%)
  330PRINTTAB(X%,Y%)CHR$(A%)TAB(X%,(Y%+1
```

Turn to Page 73

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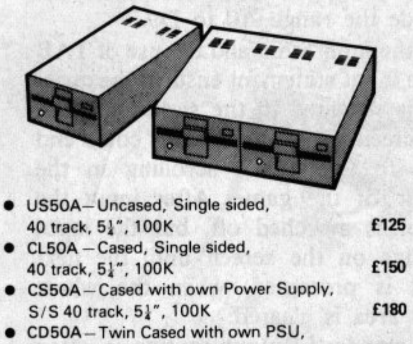

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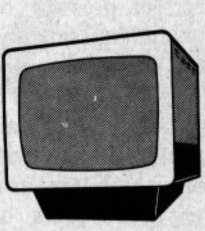

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The second article in this series looks at Mode 7 animation

TELETEXT MODE 7

By PAUL LEMAN and
STEVE SWALLOW

IN keeping with the general ease of access to useful facilities on the BBC Micro, Acorn have made it easy to generate useful teletext control codes by the use of the red function keys at the top of the keyboard. This facility is really only available with OS 1.0 onwards, but those with OS 0.1 can easily define these keys to give single Ascii codes.

The *FX calls in OS 1.0 are detailed on pages 439-440 of the User Guide. There is a small typographic error here, as the second call gives A=&E4 (228). It should be A=&E2 (226).

These *FXs allow you to define the function keys alone as well as SHIFT+function key, CTRL+function key and SHIFT+CTRL+function key. With OS 0.1, however, only the function key alone can be redefined easily. This is briefly mentioned in the User Guide, and also appeared in the first issue of BBC Micro User (see pages 67-68). It takes the form:

*KEY 0 "¦!¦A"

The f0 key will now return the Ascii value 129, the value being made up of two parts. The ¦! gives 128 and CTRL A gives 1. Having defined this, it is not immediately obvious what use it is. Ascii 129, however, is the red alphanumeric code for use in teletext mode. If we set the keys up as follows then a single key press will give us the colour graphic codes on keys f0 to f6.

```
   10 DIM K% 64
   20 X%=K%:Y%=K% DIV 256
   30 FOR I%=0 TO 6
   40 $K%="KEY "+STR$(I%)+"¦!¦"+CHR$
(I%+ 81)
   50 CALL &FFF7
   60 NEXT
   70 REM Now test the keys.
   80 REM Space bar ends.
   90 REPEAT
  100 A%=INKEY(0)
  110 IF A%<>-1 THEN PRINT A%
  120 UNTIL A%=32
```

Program I

In MODE 7 the characters are hardware generated and so this mode has very fast although obviously limited animation capabilities.

The first example is a simple anima-

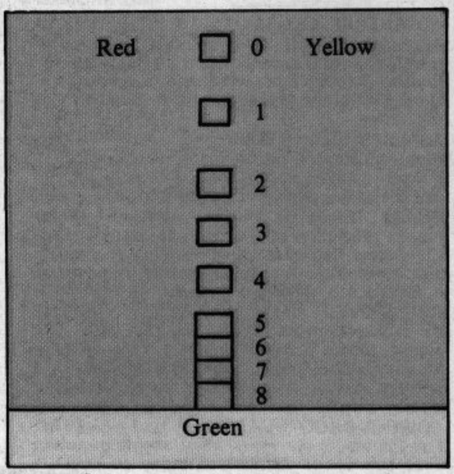
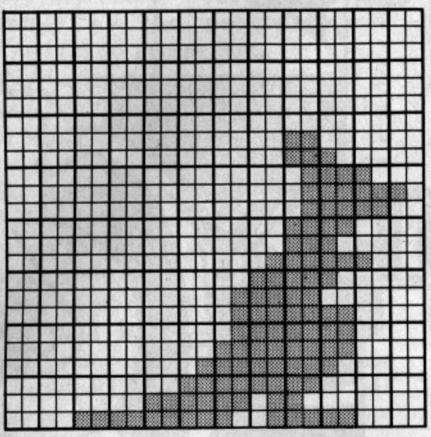
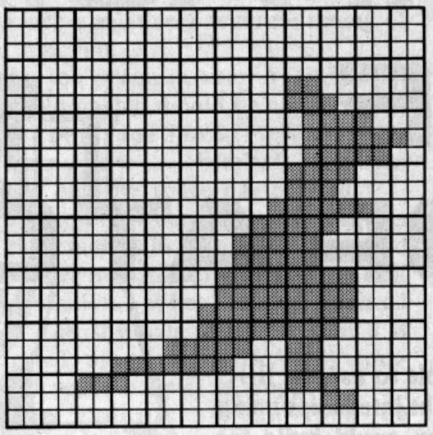


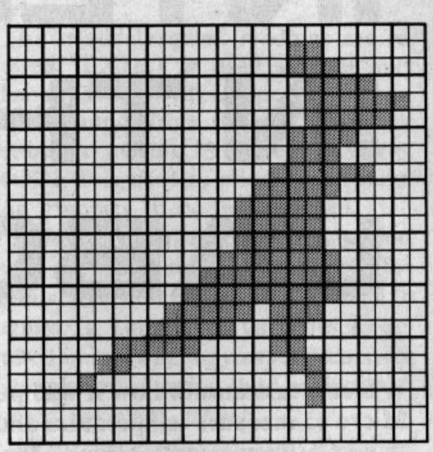
Figure I



Frame I



Frame II



Frame III

tion displaying a bouncing ball. To do this we display the ball at the positions shown in Figure I. The positions can be held in a look-up table stored in an integer array, and animation achieved by displaying all but one ball in the background colour while cycling through the array. See Program II.

This animation could in fact be done by simply printing and deleting the ball character at the required positions, but more complex repetitive animation effects can be achieved by this very simple method.

The next example is in fact easier to write in one of the normal graphics modes using a redefined character set, but is included here to show another method of animation.

Three frames are constructed using graphics characters to represent a jumping kangaroo. The most difficult part is actually constructing each frame, and I used a small program that converts redefined characters to teletext graphics characters in order to make this easier.

The trick, if there is one, of this type of animation is to let each new frame overwrite the preceding frame. The three frames are shown above on grids. The spaces to the left of the figures are there to delete parts of the preceding picture.

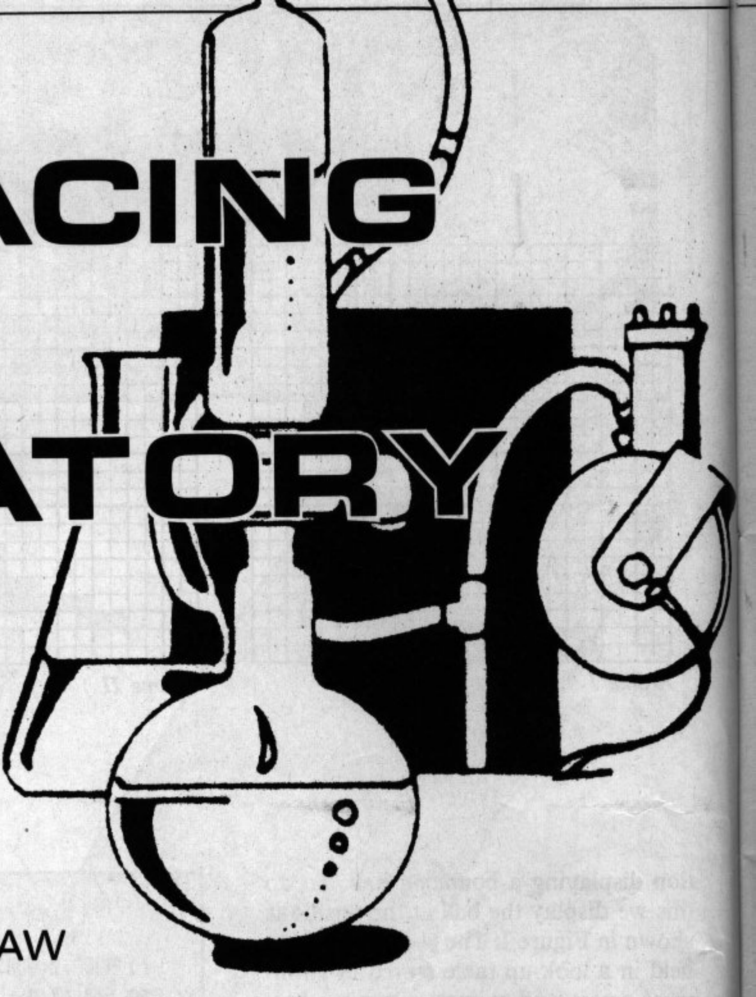
Program III forms the individual pictures from a set of data statements and then displays the animation. The program prompts for a delay time in centiseconds between frames, and finally asks if a repeat is required.

```
   10 MODE 7:VDU23;8202;0;0;0;
   20 DIM A%(8)
   30 REM
   40 REM Read in look-up table.
   50 REM Then read in delay(centisecs)
   60 REM
   70 FOR I%=0 TO 8: READ A%(I%):NEXT
   80 INPUT"DELAY(centisecs) ",WT:CLS
   90 REM
  100 REM Top 19 lines to yellow
  110 REM background, yellow foreground
  120 REM
  130 FOR I%=0 TO 19
  140 PRINTTAB(0,I%)CHR$147CHR$157CHR$1
47
  150 NEXT
  160 REM
  170 REM Bottom 3 lines green
  180 REM
  190 FOR I%=20 TO 2
  200 PRINTTAB(0,I%)CHR$130CHR$157
  210 NEXT
  220 REM
  230 REM Print 'ball', char 255 on
  240 REM lines 0 to 19
  250 REM
  260 FOR I%=0 TO 19
  270 PRINTTAB(20,I%)CHR$255
  280 NEXT
  290 REM
  300 REM  Now animate by moving back &
  310 REM forth through look-up table,
  320 REM changing graphic foreground
  330 REM colour from yellow to red at
  340 REM appropriate lines.
  350 REM
  360 PRINTTAB(2,A%(0))CHR$145:L%=A%(0)
  370 REPEAT
  380 FOR I%=0 TO 8
  390 PROCdelay
  400 PRINTTAB(2,L%)CHR$147
  410 L%=A%(I%)
  420 PRINTTAB(2,L%)CHR$(145)
  430 NEXT
  440 FOR I%= 8 TO 1 STEP -1
  450 PROCdelay
  460 PRINTTAB(2,L%)CHR$147
  470 L%=A%(I%)
  480 PRINTTAB(2,L%)CHR$145
  490 NEXT
  500 REM
  510 REM Repeat forever...
  520 REM
  530 UNTIL FALSE
  540 DATA 1,2,3,4,6,8,10,14,19
  550 DEFPROCdelay
  560 now=TIME
  570 REPEAT
  580 UNTIL TIME- now>WT
  590 ENDPROC
```

Program II

Turn to Page 84

INTERFACING IN THE LABORATORY



By MIKE SHAW

WE saw last month how it was possible to use the BBC Micro to measure temperature and light intensities using two relatively simple circuits that you could build for yourself. In this article I will describe how you can use apparatus that you may have already in your laboratory.

The basic idea is to use the 1 volt chart recorder output that is present on most modern equipment such as pH meters, colorimeters and conductivity meters. On equipment which does not possess this type of output the procedure is a little more difficult and requires extra gadgetry, as I will describe in next month's article.

As you will remember, the BBC Micro has four channels available for A/D conversion, each of which can accept a DC voltage of up to 1.8 volts.

By using the ADVAL command in Basic these voltages are converted into numbers between 0 and 65520 in steps of 16.

When an instrument such as a pH meter is used it produces a voltage change at the chart recorder output which is proportional to the meter reading.

Although the maximum output is only about 1 volt, it still will produce a range of numbers between about 0-4000 when connected to the A/D converter. This range is sufficient to incorporate into various programs.

The positive terminal (red) of the chart recorder output should be connected to one of the channel pins, that is, 4, 7, 12 or 15 and the negative terminal (black) to one of the analogue ground pins, 5 or 8 using the screened cable and 15 way D plug.

```
   10 REM *pH CURVE*
   20 REM *M. SHAW*
   30 MODE7
   40 PRINT:PRINT
   50 PRINTCHR$(141);CHR$131;CHR$157;CHR
$132;SPC(8);"pH CURVE"
   60 PRINTCHR$(141);CHR$131;CHR$157;CHR
$132;SPC(8);"pH CURVE"
   70 PRINT TAB(1)CHR$131;CHR$157;CHR$13
2;STRING$(34,"@")
   80 PRINT:PRINT"This program will prod
uce a pH curve as"
   90 PRINT"an acid /alkali titration is
 carried out"
  100 PRINTTAB(5,20);CHR$131;"PRESS SPAC
E-BAR"
  110 IF GET=32 THEN 120 ELSE 110
  120 VDU7: DIM RDINGS(100),pH(100),VOLU
ME(100)
  130 REM**ALLOWS UP TO 100 READINGS**
  140 CLS:PRINT:PRINT:PRINT"PLACE ELECTR
ODE IN FLASK AND SET pH":PRINT"METER FOR
 BUFFER"
  150 PRINT:PRINT:PRINT"PRESS SPACE-BAR
WHEN SET"
  160 IF GET=32 THEN 170 ELSE 160
  170 VDU7:RDING1=ADVAL(2)
  180 PRINT:PRINT:PRINT"WHAT IS THE pH O
F THE BUFFER ?"
  190 INPUT pH1:VDU7 :IF pH1<5THEN SCALE
=200 ELSE SCALE =500

  200 PRINT:PRINT:PRINT"HOW MUCH ACID AT
 A TIME (IN CM3)?"
  210 INPUT ALIQUOT :VDU7
  220 PRINT:PRINT:PRINT"HOW MUCH ACID IN
 TOTAL (IN CM3)?"
  230 INPUT TALACID :VDU7
  240 NUMBER=(TALACID)DIV  ALIQUOT
  250 IF NUMBER<>TALACID/ALIQUOT THEN NU
MBER=NUMBER+1
  260 CLS:PRINT:PRINT:PRINT"PLACE ELECTR
ODE IN ALKALI "
  270 PRINT:PRINT"PRESS SPACE-BAR WHEN R
EADY"
  280 IF GET =32 THEN 290 ELSE 280
  290 VDU7: RDINGS(0)=ADVAL(2)
  300 MODE1:PROCDISPLAY:PROCCHART
  310 END
  320 DEF PROCDISPLAY
  330 VDU 28,0,31,39,28 :GCOL 0,2
  340 MOVE 1280,150:DRAW 0,150:DRAW 0,10
00
  350 V=0
  360 FORAX= 0 TO 1200/NUMBER
  370 MOVE V,150
  380 DRAW V,165
  390 V=V+1200/NUMBER

  400 NEXTAX
  410 MOVE 0,RDINGS(0)/RDING1*SCALE
  420 VOLUME(1)=0 :AMOUNT=0
  425 V=1200/NUMBER
  430 FORX=1 TO NUMBER
  440 CLS
  450 PRINT"ADD ACID FROM BURETTE IN ";A
LIQUOT;" cm3 LOTS"
  460 PRINT"PRESS SPACE-BAR AFTER EACH L
OT"
```

Program I

In Program I the computer is used to take in readings from a pH meter. The chart recorder outputs from the pH meter should be attached to pins 7 (CH1) and either 5 or 8 (analogue ground) as the program uses ADVAL(2) to accept data.

The initial value of ADVAL(2) is placed into the variable RDING1 (line 170) when the pH meter is calibrated using a buffer solution. The pH of the buffer solution is passed to the variable pH1 (line 190). As the pH meter is used during a titration a graph is plotted to produce a pH curve and then values of pH can be observed in tabular form.

The data being accessed by the ADVAL(2) command is passed into the array RDINGS(X) and the pH values are calculated using the equation (line 640)

$$pH(X) = \frac{RDINGS(X)\ {*}pH1}{RDING1}$$

Program II shows how the computer can be used to study the reaction between hydrochloric acid and sodium thiosulphate solution as it takes place within the cell of a colorimeter.

In this reaction a precipitate of sulphur is produced which causes the solution to become cloudy. The increase in cloudiness causes a corresponding drop in the light transmitted through the cell hence a drop in the voltage produced at the chart recorder output of the colorimeter.

The actual end point of the reaction is difficult to detect with the naked eye, but by taking an arbitrary value of transmitted light – for example 80 per cent transmission – as an end point, it is possible to produce a timing.

```
 470 IF GET=32 THEN 480 ELSE 470
 480 RDINGS(X)=ADVAL(2)
 490 SOUND1,-15,200,2
 500  DRAW V,RDINGS(X)/RDING1*SCALE
 510 V=V+1200/NUMBER
 520 AMOUNT=AMOUNT+ALIQUOT
 530 VOLUME(X)=AMOUNT
 540 NEXTX
 550 CLS
 560 ENDPROC
 570 DEF PROCCHART
 580 PRINT"PRESS SPACE-BAR"
 590 IF GET =32 THEN 600 ELSE 590

 600 VDU26 :CLS
 610 @%=&0002020A
 620 PRINT:PRINT:PRINT
 630 FOR X=0 TO NUMBER
 640 pH(X)=RDINGS(X)/RDING1*pH1
 650 PRINT"VOLUME ";VOLUME(X);" cm3","p
H";pH(X)
 660 NEXTX
 670 ENDPROC
```

The program uses not only the ADVAL function to detect the end point but also the TIME facility to produce a relatively accurate timing of the reaction.

As the program uses ADVAL (2), the colorimeter should be connected to pins 7 (+ve) and 5 or 8 (–ve). The timer is started after the chemicals have been mixed and the space bar pressed.

The test tube containing the reagents is then placed in the colorimeter and the meter adjusted to give 100 per cent transmission. When the transmitted light intensity falls to 80 per cent it is detected using the ADVAL(2) command and the timer is stopped.

The experiment can then be repeated, but using more dilute solutions of sodium thiosulphate. The computer then produces a table showing the concentration of thiosulphate and the time taken for the reaction.

The option is then given to plot two graphs, one of concentration of thiosulphate against time and the other of concentration against the reciprocal of the time taken for the reactions.

Line graphs are not produced, but the individual points are shown corresponding to each reaction so that anomalies, or points of interest, can be clearly spotted and discussed.

By changing the program it should be possible to use the same system with more advanced students so that concepts such as rate of reaction and order can be investigated.

Other sources of inputs which can be monitored using the computer are provided by modules of the Philip Harris Data memory system and of the environmental comparator kits produced by companies such as WPA and Unilab.

These modules provide access to the measurement of, among other things, light, temperature, pH, sound level, oxygen level and conductivity.

As with the pH meter and colorimeter, the chart recorder output is used to pass data to the computer from the sensing device. One of the most interesting devices that can be used is the electronic arm produced by Philip Harris as part of the data memory system.

This device converts rotational movement and hence vertical movement into an electrical voltage output proportional to that movement. It can be used for physics investigations such as the stretching of a spring for physiological experiments in conjunction with items such as a spirometer.

Program III is a short one which shows how the electronic arm can be used to investigate the stretching of a spring. The computer uses the data from the arm to produce a graphical representation of the oscillations of the spring.

As relatively quick readings are required *FX16,1 is used so that only channel one (CH0) is operating.

The output from the arm should be connected to pins 15 and either 5 or 8. MODE 0 is used to allow high resolution graphics to be implemented.

It is worthwhile remembering that there are four separate channels for A/D conversion and so it is possible to monitor a number of variables as required in some biology experiments, for example investigating the conditions required for plant growth.

Here the electronic arm would be used to measure the growth of a plant and light, and temperature probes outlined in last month's article could be used to monitor conditions.

There are lots of other uses of these devices. If you have any ideas but are not sure what to try, drop me a line.

```
   1 *FX15,1
   2 ON ERROR GOTO 214
  10 DIM thio(10),water(10),finish(10)
  20 MODE7
  30 @%=&0002020A
  40 PROCTITLE
  50 water=0
  60 volume=10
  70 CLS
  80 PRINT TAB(0,3);CHR$131;CHR$157;CHR
$132;"HOW MANY SERIES OF REACTIONS?"
  90 INPUTseries
 100 FORS= 1 TO series
 110 thio(S)=volume
 120 water(S)=water
 130 PROCINSTRUCT
 140 volume=volume-2
 150 water=water+2
 160 IF volume<0 THEN volume=0
 170 IF water>10 THEN water=10
 180 NEXTS
 190 PROCRESULTS
 200 MODE1
 210 PROCOPTION
 214 IF ERR=17 THEN 215 ELSE REPORT
 215 CLS: VDU 19,2,7,0,0,0
 220 END
 230 DEF PROCINSTRUCT
 240 CLS
 250 PRINT:PRINT:PRINT
 260 PRINT"Carefully measure out 1ml. o
f 4M Hydro -";
```

Program II

Turn to Page 87

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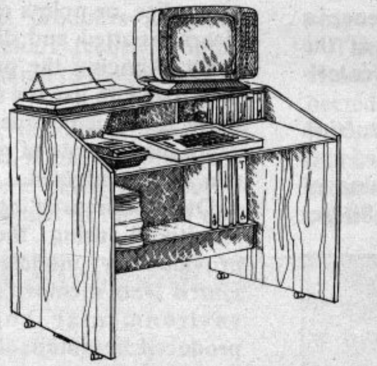

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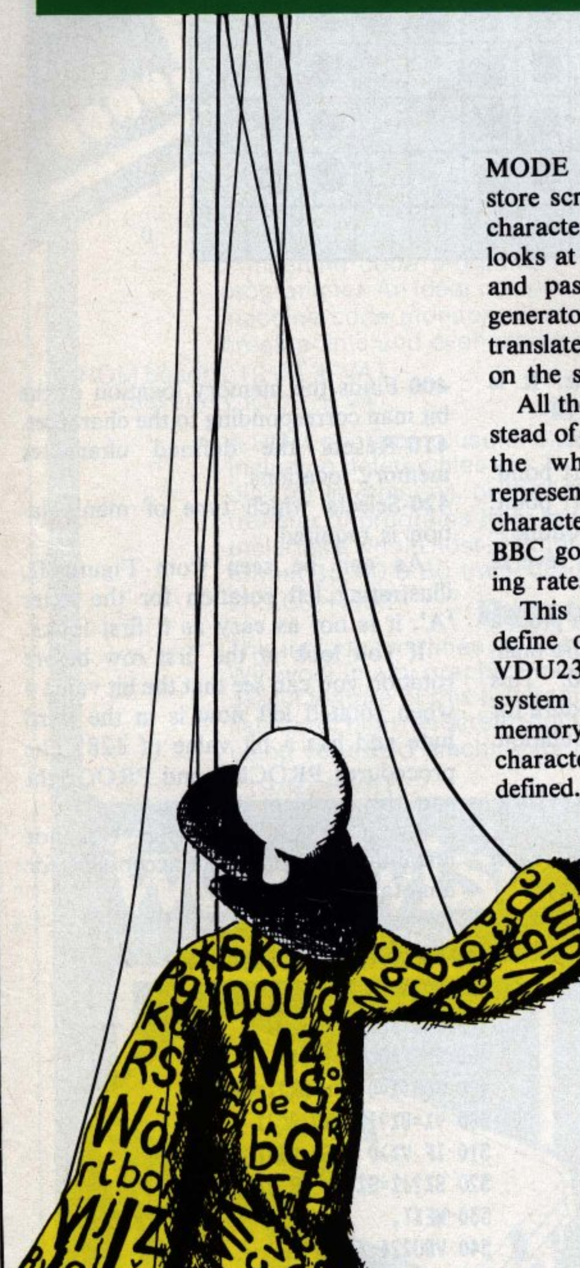
Character manipulation



By JIM NOTMAN

MODE 7 uses only 1k of memory to store screen information. To display a character on a screen the machine looks at each memory location in turn and passes its value to a character generator (5050 teletext chip) which translates this into the pattern required on the screen.

All the other modes are different. Instead of being a value which represents the whole character, each byte represents only a small part of a character. It is for this reason that the BBC gobbles up memory at an alarming rate.

This system, however, allows us to define our own characters using the VDU23 command. The operating system already reserves a section of memory from &C00 to &CFF so that character numbers 224 to 255 may be defined. Each VDU 23 command is followed by the character number and *EIGHT* bytes of data.

For instance, if we want to define the Greek character alpha first draw the character you want on a 8 x 8 grid (see Figure I). On the grid, marked along the top, is a bit value if that bit was switched on. The first byte corresponds to the first row, in this case 0. On the second row the bits with values 32, 16 and 1 are to be "switched on". These values added together make 49, the byte value for the second byte.

This must be done for each of the bytes in turn, so that to assign the alpha character to character number 240 we would use the statement VDU 23, 240, 0, 49, 74, 132, 132, 74, 49, 0.

That's how we can define a character, but what happens when the

→

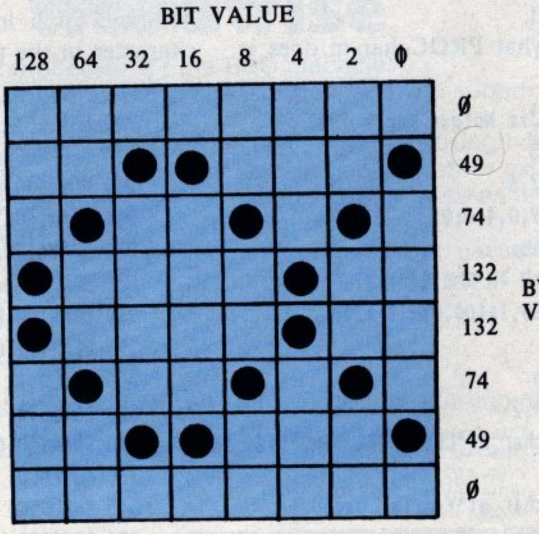


Figure I

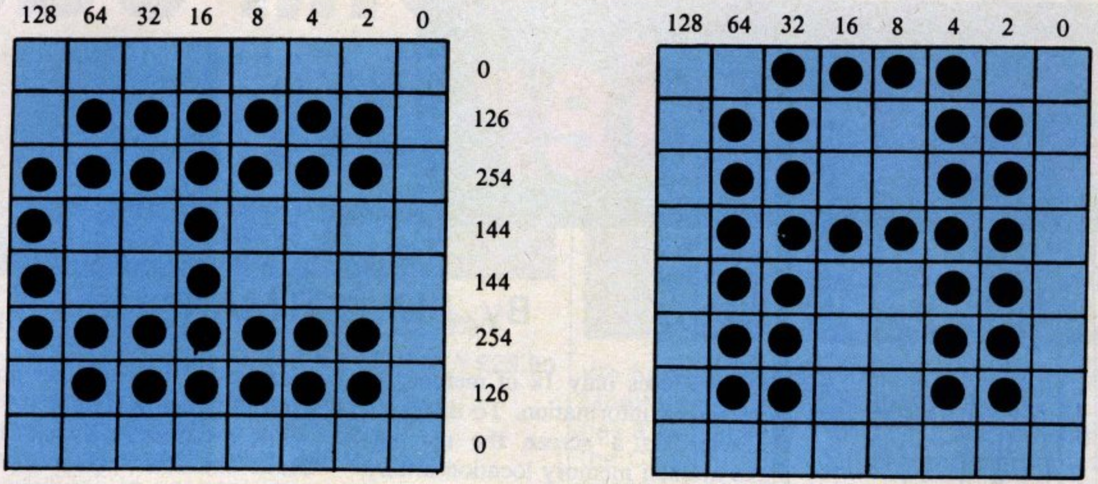


Figure II

From Page 23

machine wants to print out standard text characters? If there is no character generator for Modes 0 to 6, how does the micro know what to print out?

The answer is that there is a bit map at the start of the operating system ROM from addresses &C000 to &C2FF. Each of the Ascii character from &20 (space) to &7F in groups of eight bytes. This means that when the BBC Micro wants to print out a character it will look up the bit map for that character before transferring it to the screen. The advantage of having such an accessible table is that it can be manipulated.

This is what PROCchar_m does in the accompanying programme. It is called with four parameters:

- The string to be printed out.
- The x-co-ordinate of its start point.
- The Y-co-ordinate of its start point.
- A number which selects a routine – 1 Rotate left; 2 rotate right; 3 reverse video.

The first part of the program plots a sine wave graph to annotate the main routine starting at line 350. This routine in turn will call a procedure for each type of character manipulation.

Line:

360-Defined character memory location.

380-Sets up a loop to look at each character in the print out string.

400-Finds the memory location of the bit map corresponding to the character.

410-Resets the defined character memory locations.

420-Selects which type of manipulation is required.

As can be seen from Figure II, illustrating left rotation for the letter 'A', it is not as easy as it first looks.

If you look at the first row before rotation you can see that the bit value 4 when rotated left now is in the third byte and has a bit value of 128! The procedures PROCleft and PROCright sort this problem out.

As it is all in Basic, it's not instantaneous, but quite acceptable for annotating graphs.

```
    5 REM Jim Notman March 1983
   10 MODE5
   20 VDU12,5
   30 VDU19,0,4;0;0;
   40 PROCbox
   50 FORI=0 TO RAD(540) STEP .02
   60 PLOT69,I*100,SIN(I)*200
   70 NEXT
   80 VDU26
   90 GCOL0,2
  100 PROCchar_m("CHARACTER DEMO",180,96
0,3)
  110 PROCchar_m("Y-axis",0,450,1)
  120 PROCchar_m("-1",100,300,1)
  130 PROCchar_m("0",100,512,1)
  140 PROCchar_m("1",100,724,1)
  150 PROCchar_m("X=SINE(X)",1200,640,2)
  160 MOVE160,100:PRINT"0"
  170 MOVE400,100:PRINT"180"
  180 MOVE700,100:PRINT"360"
  190 MOVE1000,100:PRINT"540"
  200 MOVE150,32:PRINT"X-axis (degrees)"
  210 VDU4
  220 END
  230 DEFPROCbox
  240 MOVE160,896
  250 DRAW160,128
  260 DRAW1120,128
  270 DRAW1120,896
  280 DRAW160,896
  290 VDU29,170;512;
  300 GCOL0,1
  310 MOVE0,0
  320 DRAW950,0
  330 MOVE0,0
  340 ENDPROC
  350 DEFPROCchar_m(A$,X,Y,M)
  360 S%=&C00
  370 MOVE X,Y
  380 FORZ%=1TO LEN(A$)
  390 C$=MID$(A$,Z%,1)
  400 B%=&C000+(ASC(C$)-32)*8
  410 V%=0:VDU23,224,0;0;0;0;
  420 ON M GOTO430,440,450
  430 PROCleft(C$):GOTO460
  440 PROCright(C$):GOTO460
  450 PROCreverse(C$):GOTO460
  460 NEXT
  470 ENDPROC
  480 DEFPROCleft(C$)
  490 FORI%=0TO7:FORJ%=0TO7
  500 V%=B%?I% AND 2^J%
  510 IF V%>0 THEN V%=1
  520 S%?J%=S%?J% OR V%*2^(7-I%)
  530 NEXT,
  540 VDU224,11,8
  550 ENDPROC
  560 DEFPROCright(C$)
  570 FORI%=0TO7:FORJ%=0TO7
  580 V%=B%?I% AND 2^J%
  590 IF V%>0 THEN V%=1
  600 S%?(7-J%)=S%?(7-J%) OR V%*2^I%
  610 NEXT,
  620 VDU224,10,8
  630 ENDPROC
  640 DEFPROCreverse(C$)
  650 FORI%=0TO7:S%?I%=B%?I% EOR &FF:NEXT
  660 VDU224
  670 ENDPROC
```

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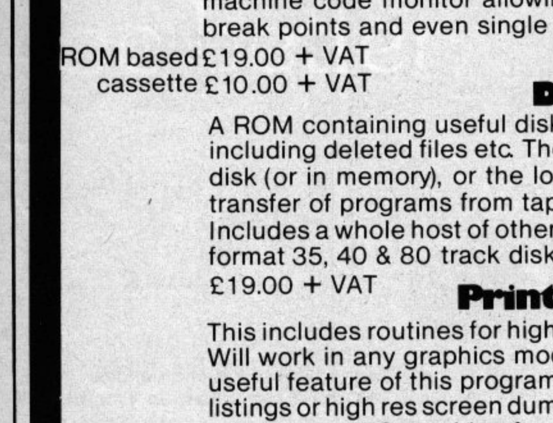
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GRAPHICS

LAST month we saw how to draw coloured lines on the graphics screen and use them to outline various shapes. Now we shall see how to fill those shapes with colour so as to really bring the screen to life.

Firstly, let's recap. We learned these new commands:

> **GCOLO,** which sets the graphics colours.
> **MOVE,** which moves the (imaginary) graphics cursor to the point specified.
> **DRAW** which draws a line, in the current foreground colour, from the last point visited by the graphics cursor to the point specified.

Program I illustrates the use of these commands to draw a red triangle similar to that of Figure I.

We can cause the triangle to be filled in with colour by using a new statement, PLOT 85. Before we go into it in detail, I suggest that you run Program II to get a feel of what happens – it draws the same triangle as Program I, this time completely filled with red, the graphics foreground colour.

When you think about it, you can specify a triangle on the screen by giving the co-ordinates of its three corners. Now PLOT 85 is the BBC Micro's triangle-filling command. When the machine receives this command it needs to know those three sets of co-ordinates.

You always follow PLOT 85 with the co-ordinates of one of the points.

For example, in Program II, line 70 uses PLOT 85,640,1020, since the co-ordinates of the top of the triangle are (640,1020). But how does the BBC Micro know where to get the other two points to complete the triangle?

Well, it takes it for granted that the other two points are the last two points the graphics cursor has visited before it meets the PLOT 85 statement.

So when you are programming you have to keep track of the last two positions the graphics cursor has visited – remembering that both MOVE and DRAW affect this.

```
10 REM *** PROGRAM ONE ***
20 MODE 5
30 GCOL0,1
40 GCOL0,130:CLG
50 MOVE 10,10
60 DRAW 1270,10
70 DRAW 640,1020
80 DRAW 10,10
```

Program I

```
10 REM *** PROGRAM TWO ***
20 MODE 5
30 GCOL0,1
40 GCOL0,130:CLG
50 MOVE 10,10
60 MOVE 1270,10
70 PLOT 85,640,1020
```

Program II

If the last two points are unsuitable for the triangle you want to draw you have to fix this by using MOVE to visit the appropriate points.

In Program II lines 50 and 60 use MOVE to visit the first two points of the triangle. Line 70 then uses PLOT 85 to specify the last point and fill in the triangle defined with the current foreground colour. Figure II should make this clear.

This ability to fill triangles is the key to the whole business of graphics.

All the other shapes you see in BBC Micro programs are constructed from triangles – even the circles!

It is worth spending some time now playing with variations of Program II. It's easy to read and understand what we've been doing so far – but it is another thing to put the ideas to use.

So please, before you continue, have a go at writing programs, based on Program II, to draw your own triangles

Figure I

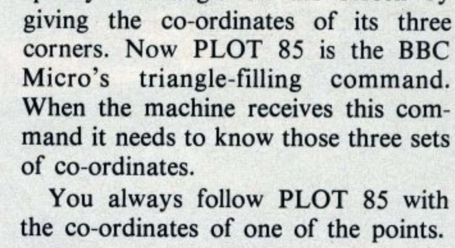
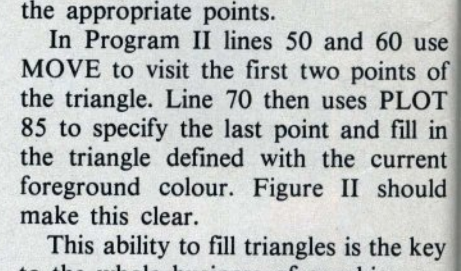
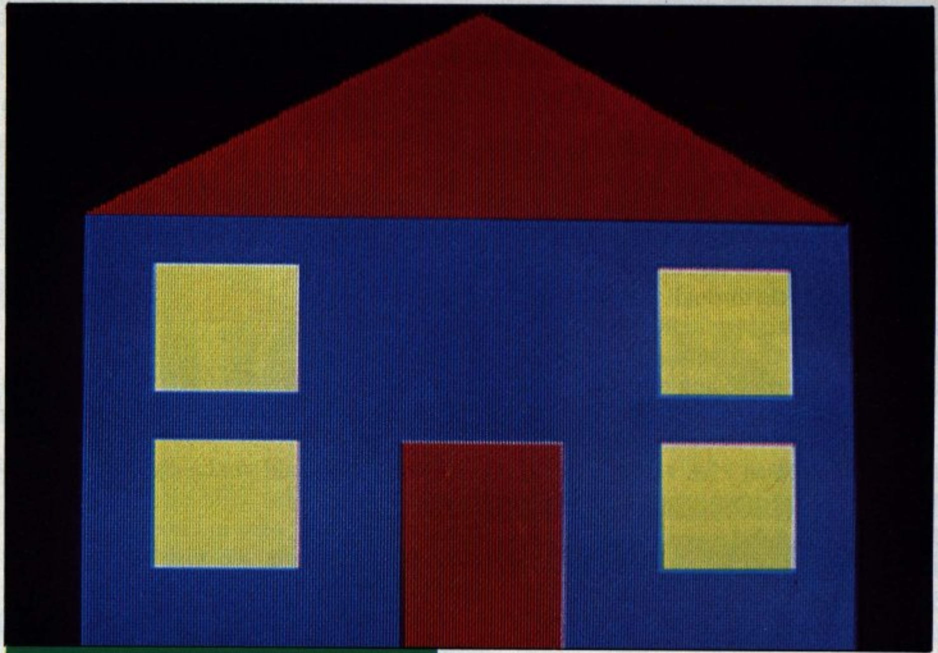


Figure II


(640,1020)
Final point visited (line 70)
(10,10)
First point visited (line 50)
(1270,10)
Second point visited (line 60)

```
 10 REM *** PROGRAM THREE ***
 20 MODE 5
 30 VDU 19,3,4,0,0,0
 40 VDU 19,0,7,0,0,0
 50 GCOL 0,128 : CLG
 60 REPEAT
 70 firstx=RND(1200)
 80 firsty=RND(1000)
 90 secondx=RND(1200)
100 secondy=RND(1000)
110 thirdx=RND(1200)
120 thirdy=RND(1000)
130 colour=RND(3)
140 GCOL0,colour
150 MOVE firstx,firsty
160 MOVE secondx,secondy
170 PLOT 85,thirdx,thirdy
180 FOR I=1 TO 1000:NEXT I
190 UNTIL FALSE
```

Program III



Let colour bring the screen to life..

By PAUL JONES

on the screen. Try changing their size and colour.

Then write a program to put two on the screen at once. Can you make them different colours? What happens if they overlap? And what happens if you change MOVE in lines 50 and 60 to DRAW? (Putting in a line 75 to change the graphics colour might help here.)

Program III uses the ideas of Program II to generate a random sequence of triangles.

Line 20 sets the mode.

Lines 30 and 40 alter the colour assignments of logical colours 3 and 0 respectively.

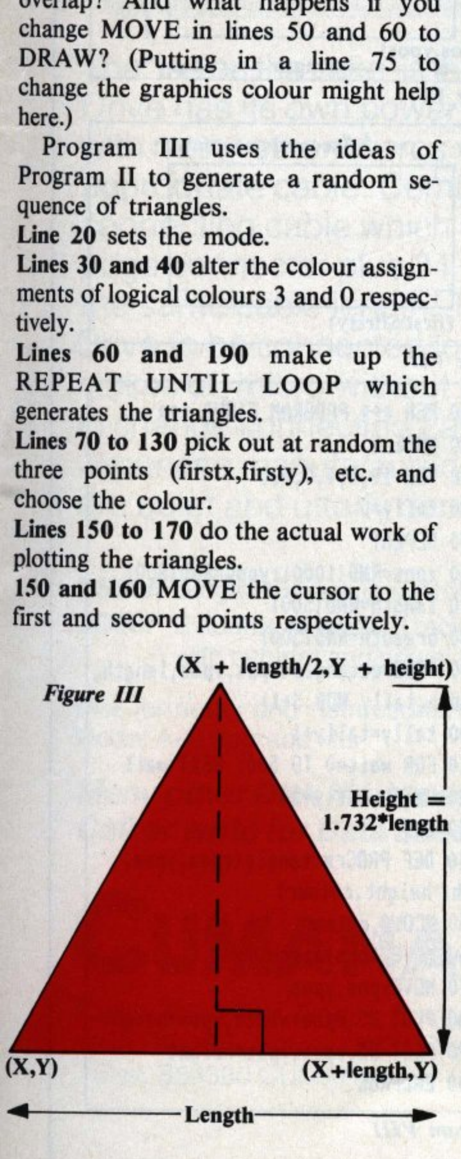
Lines 60 and 190 make up the REPEAT UNTIL LOOP which generates the triangles.

Lines 70 to 130 pick out at random the three points (firstx,firsty), etc. and choose the colour.

Lines 150 to 170 do the actual work of plotting the triangles.

150 and 160 MOVE the cursor to the first and second points respectively.

Figure III



Line 170 fills the triangle between these and the third point with a PLOT 85.

If the program were any more complex it would have been better to put the triangle-drawing part of it in a procedure. This is the strategy we adopt in Program IV, which prints out 50 random equilateral triangles on the screen by repeatedly calling PROCtriangle.

If you experience a feeling of déjà vu when you look at PROCtriangle, don't worry – it is virtually identical to the procedure of that name in last month's Program IX, save that we use PLOT 85 since we are filling in triangles rather than drawing outlines. There's a lot to be gained from comparing both procedures.

Figure III should also help make PROCtriangle clearer. Line 60 randomly chooses the position of the left hand corner of the triangle (xpos,ypos). Line 70 fixes the size of the triangle. Tally counts the number of times the REPEAT UNTIL loop (lines 50 to 110) is repeated.

A little thought should show you that tally MOD 3 + 1 returns the values 1,2,3,1,2,3,1,2,3 cyclically.

We use this to cycle through the colours for the triangle by passing tally MOD 3 + 1 to the variable colour in the procedure call (lines 80 to 130).

Last month we not only used PROCtriangle to draw the random triangle outlines, we also used it in Program X to draw the nested triangles that featured in Page 33's colour photo.

This month I have followed in the

→

```
 10 REM *** PROGRAM FOUR ***
 20 MODE 5
 30 VDU 19,3,4,0,0,0
 40 tally=0
 50 REPEAT
 60 xpos=RND(1000):ypos=RND(800)
 70 size=RND(500)
 80 PROCtriangle(xpos,ypos,size,
tally MOD 3+1)
 90 tally=tally+1
100 FOR wait=0 TO 500: NEXT wait
110 UNTIL tally=50
120 END
130 DEFPROCtriangle(x,y,length,col
our)
140 LOCAL height
150 GCOL0,colour
160 height=length*1.732/2
170 MOVE x,y
180 MOVE x+length,y
190 PLOT 85,x+length/2,y+height
200 ENDPROC
```

Program IV

From Page 29

same vein by using PROCtriangle from Program IV to produce a series of colour-filled triangles, as you will see if you run Program V.

In Program V we not only use tally to once more cycle through the colours, but also to alter the position and size of the triangle, so that each successfully nests within the preceding one (lines 80 to 110).

```
10 REM *** PROGRAM FIVE ***
20 MODE 5
30 VDU 19,3,4,0,0,0
40 tally=0
50 size=1000
60 height=1.732*size/2
70 REPEAT
80 base=size - tally*250
90 up=height*tally/4
100 xpos=100 + 250 * tally/2
110 ypos=up/2 + 100
120 PROCtriangle(xpos,ypos,base,tally
MOD 3+1)
130 tally=tally+1
140 UNTIL tally > 3
150 END
160 DEFPROCtriangle(x,y,length,colour)
170 LOCAL height
180 GCOL0,colour
190 height=length*1.732/2
200 MOVE x,y
210 MOVE x+length,y
220 PLOT 85,x+length/2,y+height
230 ENDPROC
```

Program V

Program VI uses two different coloured triangles positioned to give a multicoloured rectangle. It does this by repeating our triangle drawing formula:

1. MOVE to first point
2. MOVE to second point
3. PLOT 85 to third point.

```
 10 REM *** PROGRAM SIX ***
 20 MODE 5
 30 VDU 19,3,4,0,0,0
 40 REM First triangle
 50 GCOL0,1
 60 MOVE 0,0
 70 MOVE 1279,0
 80 PLOT 85,1279,1023
 90 REM Second Triangle
100 GCOL0,3
110 MOVE 0,0
120 MOVE 0,1023
130 PLOT 85,1279,1023
```

Program VI

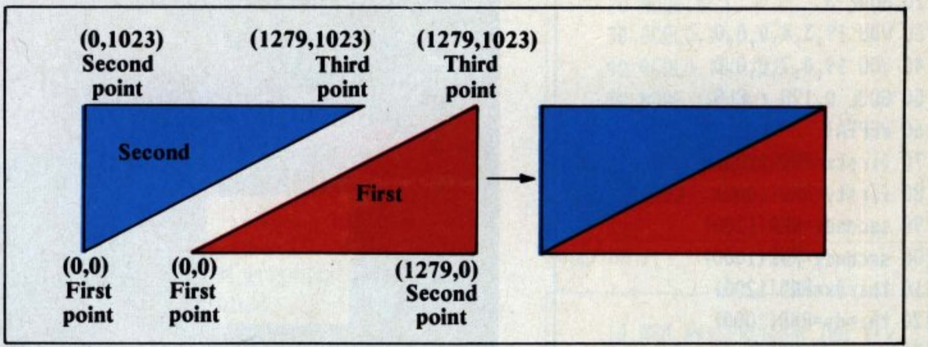


Figure IV

Figure IV should make this clear. This is not the most efficient method, though. If we take care in choosing the order of the points we visit we can arrange that the last two points visited in order to draw the first triangle become the first two points of the second.

That is, having drawn the first triangle, we can then draw the second with just another PLOT 85 to supply the final point.

Program VII uses this method to produce the same output as Program VI. Figure V should illustrate the idea.

```
 10 REM *** PROGRAM SEVEN ***
 20 MODE 5
 30 VDU 19,3,4,0,0,0
 40 REM First triangle
 50 GCOL0,1
 60 MOVE 1279,0
 70 MOVE 1279,1023
 80 PLOT 85,0,0
 90 REM Second Triangle
100 GCOL0,3
110 PLOT 85,0,1023
```

Program VII

To show how important the order of visiting the points is when you're using this method, try swapping lines 60 and 70, then run the program.

If you think about it, we can use this technique in a procedure to draw rectangles – though we'd probably have both triangles the same colour!

In fact, we use this in PROCrectangle in Program VIII. The procedure assumes that the sides of the rectangle are parallel to the axes, that is that the rectangle does not slope. Figure VI should help make the procedure's variables clear.

The program simply computes random values for those variables (once more using tally MOD 3 + 1 to pick colours) and calls PROCrectangle 50 times to produce random rectangles in much the same manner as

→

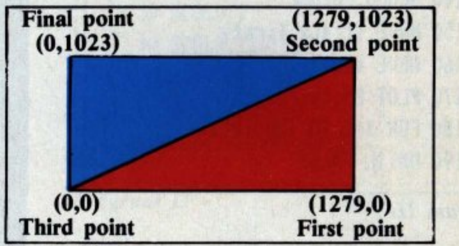


Figure V

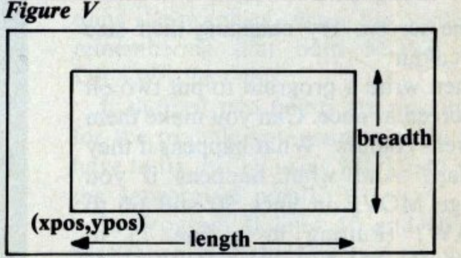


Figure VI

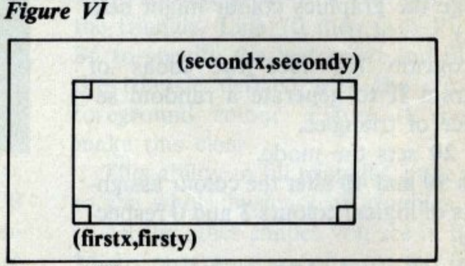


Figure VII

```
 10 REM *** PROGRAM EIGHT ***
 20 MODE 5
 30 VDU 19,3,4,0,0,0
 40 tally=0
 50 REPEAT
 60 xpos=RND(1000):ypos=RND(800)
 70 length=RND(500)
 80 breadth=RND(500)
 90 PROCrectangle(xpos,ypos,length,
breadth,tally MOD 3+1)
100 tally=tally+1
110 FOR wait=0 TO 500: NEXT wait
120 UNTIL tally=50
130 END
140 DEF PROCrectangle(xpos,ypos,
width, height,colour)
150 GCOL0,colour
160 MOVE xpos+width,ypos
170 MOVExpos,ypos
180 PLOT 85,xpos+width,ypos+height
190 PLOT 85,xpos,ypos+height
200 ENDPROC
```

Program VIII

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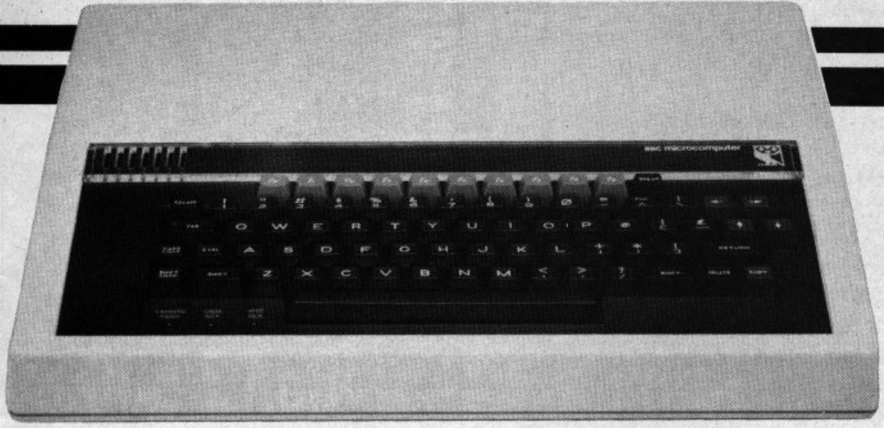

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From Page 30

we produced random triangles in Program IV.

Continuing with this theme of adapting previous programs, Program IX uses PROCrectangle to produce a series of nested rectangles in a manner strictly analogous to the way that Program V produced nested triangles. Lines 70 to 100 ensure that successive rectangles nest by altering the side lengths and the corner positions.

Although I normally use the above procedure for rectangles, there is another way of defining a rectangle (again assuming it doesn't slope). This is by simply giving the procedure the co-ordinates of two diagonally opposite corners of the rectangle.

Figure VII shows the method. Program X uses it in PROCectangle to produce a "staircase" of six rectangles. Each successive rectangle is drawn ystep graphical units taller then the preceding one and xstep graphical units to the right.

```
   10 REM *** PROGRAM NINE ***
   20 MODE 5
   30 VDU 19,3,4,0,0,0
   40 tally=0
   50 length=1000:breadth=800
   60 REPEAT
   70 width=length*(4-tally)/4
   80 height=breadth*(4-tally)/4
   90 xpos=100 + 500*tally/4
  100 ypos=100 + 400*tally/4
  110 PROCrectangle(xpos,ypos,width,
height,tally MOD 3+1)
  120 tally=tally+1
  130 UNTIL tally > 3
  140 END
  150 DEF PROCrectangle(xpos,ypos,
width, height,colour)
  160 GCOL0,colour
  170 MOVE xpos+width,ypos
  180 MOVExpos,ypos
  190 PLOT 85,xpos+width,ypos+height
  200 PLOT 85,xpos,ypos+height
  210 ENDPROC
```

Program IX

```
   10 REM *** PROGRAM TEN ***
   20 MODE 5
   30 VDU 19,3,4,0,0,0
   40 VDU 19,0,5,0,0,0
   50 bottomx=0:bottomy=0
   60 topx=0:topy=0
   70 xstep=213:ystep=170
   80 counter=0
   90 REPEAT
  100 colour= counter MOD 3+1
  110 topy=topy+ystep
  120 topx=bottomx+xstep
  130 PROCrectangle(bottomx,bottomy,
topx,topy,colour)
  140 bottomx=topx
  150 counter=counter+1
  160 UNTIL counter=6
  170 END
  180 DEF PROCrectangle(firstx,fir
sty,secondx,secondy,colour)
  190 GCOL0,colour
  200 MOVE secondx,firsty
  210 MOVE firstx,firsty
  220 PLOT85,secondx,secondy
  230 PLOT 85,firstx,secondy
  240 ENDPROC
```

Program X

Although the output may seem rather trivial, it is by using much the same techniques that we are able to draw bar charts and graphs, as we shall see in later issues.

In the meantime, why not practice your graphic techniques by writing programs to draw simple, multi-coloured pictures constructed from triangles and rectangles? Houses, rockets and boats seem to be favourite subjects.

Useful things to know

ROM insurance can save your program

IF you're the type of person who always has to go back three times to check that his front door is locked, you probably share my sense of insecurity when it comes to saving programs. The BBC Micro might well be indicating that saving is complete, but how do you know that you will be able to reload the program from tape?

***CAT might show you what's on the tape, but that's no guarantee that it will load. And, of course, you can't try a simple LOAD command because, in the process of trying to load the version on tape, you overwrite your original – so, if the loading fails for any reason, you're in a real mess.**

The answer is to use the command

***LOAD""8000**

which will load the first program it encounters on tape, not to the place it normally loads Basic programs, but to memory locations &8000 onwards.

Now these memory locations are ROM, which means that their contents are fixed. The computer can try as much as it wants to try to change the values of these locations (say, by loading a program into them, as in this case), but it won't succeed.

The micro is blithely unaware of this fact though, and will continue to load into the ROM until it reaches the end of the program on tape.

Once there, if the program was properly saved in the first place, it will return to Basic, considering that it has completed its task successfully.

We can now breathe sighs of relief, since we then know that the program on tape is capable of being loaded by the system.

If, however, the program on tape fails to load, or an error message is generated, all is not lost. By using *LOAD""8000 and thus loading to an area of ROM, the memory which our original program occupied remains untouched. That is, the program we have attempted to save remains intact, so we can now try to save it again – hopefully with more success.

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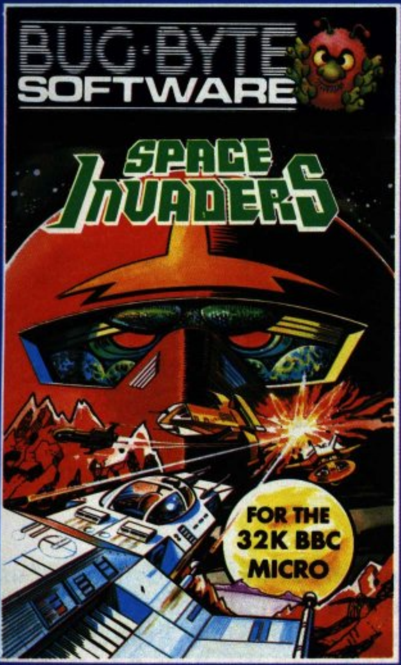
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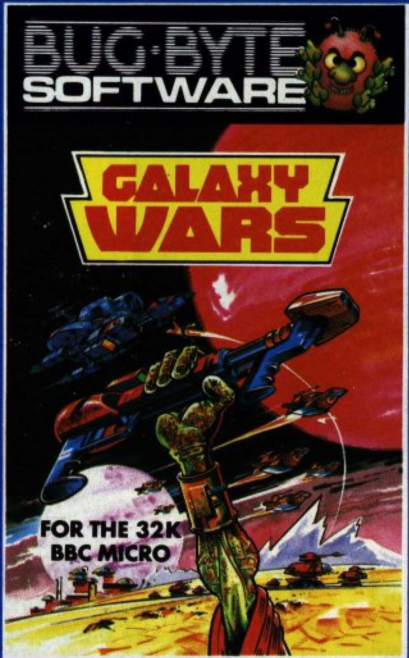
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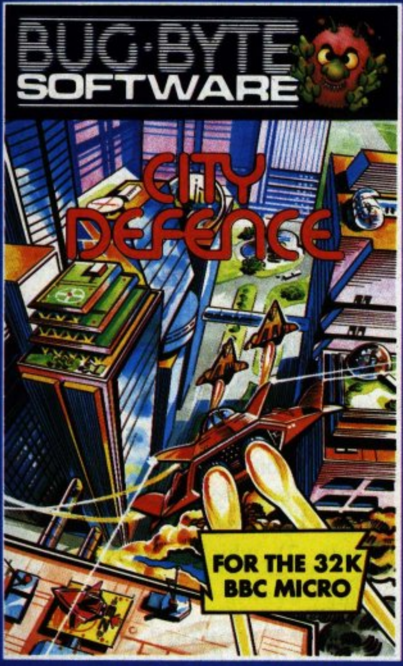
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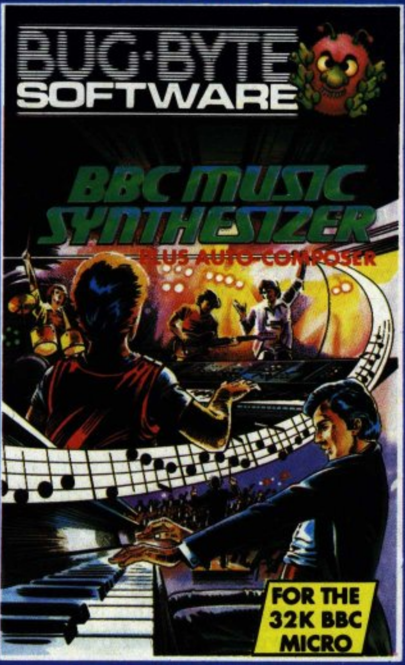
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BITS & BYTES

MIKE BIBBY continues his explanation of the fundamentals of the BBC Micro workings

So how are you at decomposing?

WE have seen that we can code our numbers in ways other than our usual denary, or decimal, system. We also looked last month at a way of coding known as the binary system, which uses the digits 0 to 1 to represent any number – unlike the denary system which uses the digits 0 to 9. To distinguish the two systems, we decided to prefix binary numbers with the symbol "%".

The number "one hundred and sixty – two" is encoded in each system as follows:

In denary,

162 i.e. 100+60+2

In binary,

```
  128 64 32 16 8 4 2 1
%   1  0  1  0 0 0 1 0
      i.e. 128+32+2
```

Each column in the binary system, known as a "bit", contains either a one or a zero. Although the binary representation of a number is rather cumbersome to write, this simple two-state system is easily represented by electrical circuits – which are either ***on*** or ***off***.

We saw that the computer handles bits in groups of eight at a time. Such a group is called a byte. Thus a byte contains eight bits labelled, somewhat peversely, bits 0 to 7. See Figure I.

Bit 0, as you can see , is the "1" column. As this is the smallest value bit we say that bit 0 is the least significant bit (LSB). Bit 7, the "128" column, is called the most significant bit (MSB). The reason for using the numbers 0 to 7 to label the bits instead of the more logical 1 to 8 has to do with powers, a subject you almost certainly covered at school.

"2 to the power 2" is 2*2 = 4
"2 to the power 3" is 2*2*2 = 8
"2 to the power 4" is 2*2*2*2 = 16
and so on. "2 to the power 8" would be eight twos all multiplied together.

Notice as the powers of two increase – that is, as we multiply more twos together – the answers are doubling, just as our column or bit values do.

Also, 2 to the power of 2 is 4, the value of bit 2, while 2 to the power of 3 is 8, the value of bit 3. It shouldn't come as any surprise to you to find that 2 to the power of 7 is 128, the value of bit 7.

You can verify this on the BBC Micro by using the symbol "^" ("↑" in Mode 7) which stands for "to the power of".

Try:

```
PRINT 2↑4
PRINT 2↑7
```

Be sure to try 2^1, which will show you why bit 1 has the value 2. Also try 2↑0. The answer may surprise you. The fact is that any number to the power 0

Bit number	7	6	5	4	3	2	1	0
	1	0	0	0	1	1	0	1
Bit value	128	64	32	16	8	4	2	1

Figure I: The bit pattern for 141

Bit number	7	6	5	4	3	2	1	0
Bit value	2↑7 128	2↑6 64	2↑5 32	2↑4 16	2↑3 8	2↑2 4	2↑1 2	2↑0 1
	1	1	0	0	1	1	0	0

Figure II: The bit pattern for 204

is 1! Hence bit zero has the column value of one. Figure II illustrates this.

Look at this sum:

$$\begin{array}{r} \%\ 1 \\ +\ \%\ 1 \\ \hline \%10 \end{array}$$

If you think about it, that is correct, since the sum adds one and one, and the answer %10 is binary for two. One way of relating this to our usual way of doing sums is to say that we carry when we get to two, instead of ten as we do in our normal, decimal, sums.

Another way to look at it is that we have to carry when we get to two because we aren't allowed to use the digit '2'. If you remember, last month we had a rule forbidding two "coins" of the same value.

Try this sum:

$$\begin{array}{rccclr} & \mathbf{4} & \mathbf{2} & \mathbf{1} & & \\ \% & & 1 & 1 & \text{in} & 3 \\ +\ \% & & 1 & 0 & \text{denary} & +\ 2 \\ \hline \% & 1 & 0 & 1 & & 5 \end{array}$$

Here we carry from the second column to the third.

Addition is not very hard at all – just make sure that you always "put 0 down and carry 1" when you get a two. If you get a three then "carry one for two and put one down".

For example:

$$\begin{array}{rcccclr} & \mathbf{8} & \mathbf{4} & \mathbf{2} & \mathbf{1} & & \\ \% & & 1 & 1 & 1 & \text{in} & 7 \\ +\ \% & & & 1 & 1 & \text{decimal} & +3 \\ \hline \% & 1 & 0 & 1 & 0 & & 10 \end{array}$$

Subtraction is a little more complicated, and depends on whether you borrow or decompose! That latter phrase doesn't describe the current economic climate, it's just that there are two schools of thought on the way subtraction should be taught – the borrowers and the decomposers.

Fortunately, we can ignore binary subtraction since we can manage without it – as does the microprocessor inside your machine. If you want to do some binary subtraction it is straightforward enough provided that you remember that it is two you're borrowing or taking, not ten. Figure III illustrates the process – without any attempt to explain it.

Before we leave the realm of simple sums, look what happens if we shift everything in a binary number over to the left, putting a zero into bit 0, which would be left vacant otherwise. For example:

$$\begin{array}{rccccl} & \mathbf{8} & \mathbf{4} & \mathbf{2} & \mathbf{1} & \\ \% & & 1 & 0 & 1 & \text{which is 5} \end{array}$$

becomes

$$\begin{array}{rccccl} & \mathbf{8} & \mathbf{4} & \mathbf{2} & \mathbf{1} & \\ \% & 1 & 0 & 1 & 0 & \text{which is 10} \end{array}$$

This shifting to the left doubles the number automatically. This isn't too hard to visualise, because the value of each bit is transferred to the next higher bit, which is of course double in value – so the end result is that the whole number is doubled in value.

Similarly, we can do the binary equivalent of DIV 2 by shifting to the right. For example:

$$\begin{array}{rccccl} & \mathbf{8} & \mathbf{4} & \mathbf{2} & \mathbf{1} & \\ \% & 1 & 1 & 0 & 1 & \text{which is 13} \end{array}$$

becomes

$$\begin{array}{rccccl} & \mathbf{8} & \mathbf{4} & \mathbf{2} & \mathbf{1} & \\ \% & & 1 & 1 & 0 & \text{which is 6} \end{array}$$

and, of course, 13 DIV 2 gives you 6. (The DIV command, in case you aren't familiar, deals with integer division, that is, it does division but only tells you the "wholes" and ignores the remainders.)

As each bit is moved to the right, it occupies a column exactly one half lower in value, thus the sum total of all the bits is one half lower, save for the original bit 0 which has disappeared altogether (hence the ignored remainder).

Well, that's enough binary for one month. Hexadecimal blooms in June!

$$\begin{array}{rccc} \% & {}^{0}\cancel{1} & {}^{1}\cancel{1}^{0} & {}^{1}\cancel{0} \\ -\% & & 1 & 1 \\ \hline \% & & 1 & 1 \\ \hline \end{array} \qquad \textbf{OR} \qquad \begin{array}{rccc} \% & 1 & {}^{1}1 & {}^{1}\cancel{0} \\ -\% & {}^{1} & {}^{1}\cancel{1}^{0} & 1 \\ \hline \% & & 1 & 1 \\ \hline \end{array} \qquad \textbf{In decimal} \quad \begin{array}{r} 6 \\ -3 \\ \hline 3 \\ \hline \end{array}$$

Decomposition **Borrowing**

Figure III: Binary subtraction

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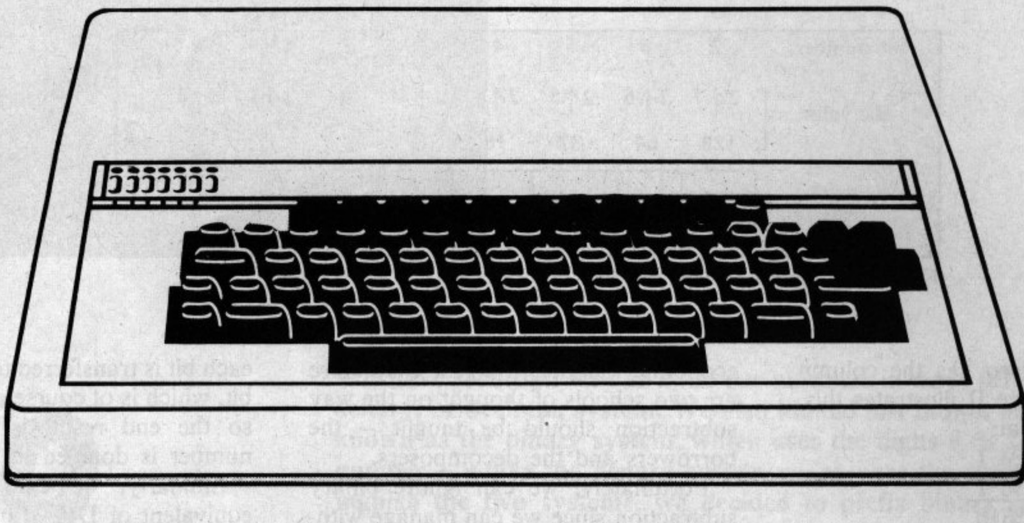

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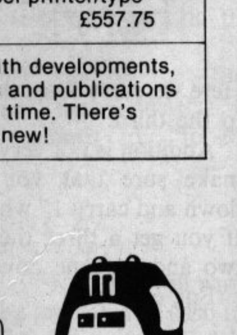

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You really can't manage without a lever device for inputting information as a two-dimensional vector?

So build a joystick!

THE BEEB BODY BUILDING COURSE

By MIKE COOK

IN the previous two articles of this course we saw how a model A could be upgraded to a model B. This month I'd like to explore the topic of joysticks.

The joystick sold by Acorn is quite reasonably priced, but it is possible to undercut it by building it yourself. You can then mount it in the sort of housing that suits you best. If you already have the joystick for the Atari games computer we shall be seeing how to interface it to the BBC computer.

Part of the rationale behind including the A/D converter in the BBC Micro is to allow the connection of a joystick. It is possible to connect one to the user port, but as this is not the way Acorn planned it there will be no supporting software for that type of configuration. So I will only talk about fitting a joystick to the A/D connector.

To make the connection you will need a 15-way D-type plug with solder cup connections. If you look very carefully on the wiring side you will see the pin numbers printed on that side of the plug. The BBC Micro is capable of supporting two joysticks, and the connections for the second one are shown on all the diagrams *in brackets*.

A joystick is a lever device for inputting information as a two dimensional vector. Sounds impressive doesn't it? You can rehearse the phrase and slip it quietly into the conversation when boasting about your latest score on Snapper!

Despite what has been said elsewhere, using a joystick for Snapper improved my score fourfold at a stroke. As far as I know, Snapper is the only Acorn game to support a joystick at the moment, but I'm sure there will be more before long.

There are basically two types of joystick, and both will work with Snapper. The simpler is the switch type, where moving the joystick in any one of four directions will close one of four switches. This is the type found on many arcade games and can be fitted to the user port as well as the A/D socket.

The second sort is the proportional type, which inputs a value that is proportional to how far over the stick is moved. This type can only be fitted to the A/D input, and this is the one we'll look at first.

If you cast your mind back to the first issue of BBC Micro User you will remember an article by Mike Shaw about adding a paddle to the computer. In essence the addition of a joystick can be achieved in a similar way by using one potentiometer, variable resistor or volume control – they are all the same thing with different names – for each axis of movement.

However, you will need to convert the rotational movement of each pot (potentiometer) into the lateral movement required. This can be achieved quite simply as follows. One pot is fixed to a bracket and the other pot is attached to it by bolting the shafts together at right angles. A lever is then connected to the body of the second pot – and there you have your joystick! If you study photo No. I you will see the construction clearly.

You must arrange that the travel of the pots covers the mechanical range

→

From Page 37

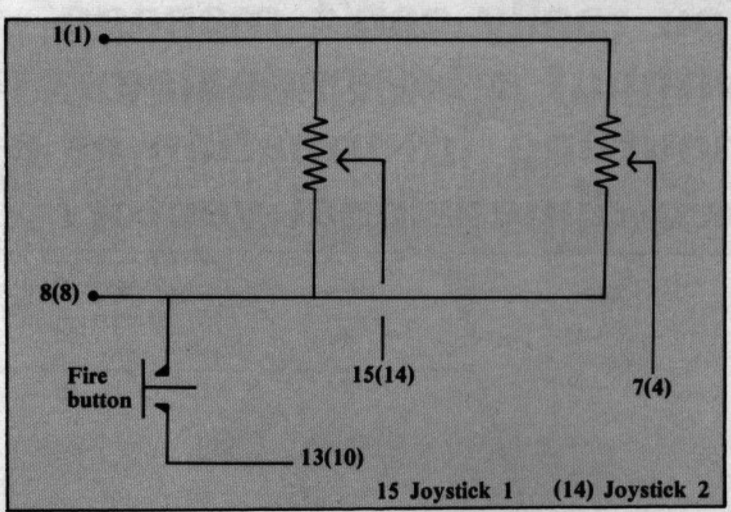

Figure I: Resistor Joystick

you are interested in. This can be achieved simply by rotating them in their fixings. For the more mechanically able, you might like to put a kink in the lever so that it is in line with the centre of movement. This will improve the feel of the joystick, but is not essential.

The circuit in Figure I shows how this can be wired up for one joystick. If you want a second, repeat the circuit using the connections shown in brackets.

Although this is the first circuit diagram we have seen in this series, I am not going to delve into the relationship between the physical appearance of a component and its circuit symbol. To do so would be a little tedious to those already familiar with it and many books are available on simple electronics which show it more clearly than I could in this article. Such books are available at most libraries and are sometimes found in the children's section, so don't be put off looking in there.

The value of the pots you use is not critical and any value between 1,000 ohms and 1 megohm can be used, but they must be of the linear type, not logarithmic. You will also see in Figure I that a "push to make" switch is needed. This is the "fire" button and can be used for several things. In Snapper it tells the program to look at the A/D port for movement instructions instead of at the keyboard.

The only snag with this type of construction is that as the pot is not being moved over the whole of its range you will not get the maximum range of numbers of which the A/D converter is capable.

This situation can be improved by connecting one end of the pots, not to the reference voltage, as was the case with the games paddles, but to a higher voltage. As there is a 5V output from the A/D socket it is convenient to use this as shown in Figure I.

THE BEEB BODY BUILDING COURSE

For the less adventurous, it is possible to purchase joystick assemblies of this type. A low cost one is available for under £3 from Tandy stores. Also Radio Spares supply a joystick assembly (stock No. 162-732) which is shown in photo No. 2. You will also see that I have mounted it in a small plastic box. I took the sharp edges off with a file and it is quite comfortable to hold.

This assembly enjoys the luxury of a spring which returns the lever to its centre position and also a grub screw adjustment on the position of the pots. On mine I had to adjust this to get Snapper to work properly. To do so, simply run the game and adjust the rotation of the pot until the Snapper can be steered in both directions. Then tighten up the grub screw and adjust the up and down in the same way.

If you get control in the wrong direction and pressing the lever left turns Snapper right just swap over the two outside connectors of the pot. This applies to all the types of joystick I have described so far.

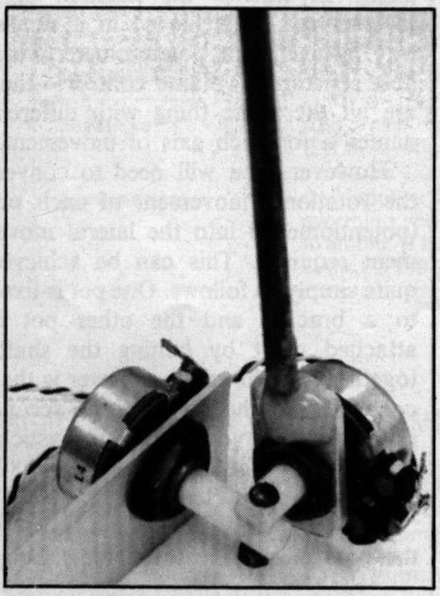

Photo I: A two-potentiometer joystick

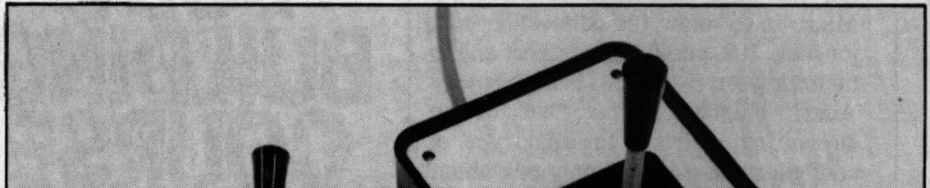

Photo II: Radio Spares joystick assembly

If you do not have Snapper, and are itching to have a go with your joystick, listing No. I shows a simple program which allows you to draw on the screen using the joystick. Lines 50 and 60 input the values from the joystick. The DIV 64 part should always be added, as the A/D converter has only 10 bits resolution, and this returns numbers in the range 0 to 1023.

According to the User Guide the A/D converter is capable of 12 bits resolution (0 to 4095), but this is not the case. I have seen an internal technical memo from NEC (the company who made the chip) saying that the two least significant bits do change but they represent only internal noise, and that this chip should be described in future as a 10 bit chip and not 12 bit. So when looking at the values from the A/D port you should always use

ADVAL(N) DIV 64

to avoid any unnecessary fluctuations in the number returned. In the program, lines 80 and 90 waste time until a new value has been taken for both channels. This happens automatically, and each channel is updated every 40 ms.

```
 10 CLS
 20 PRINT "JOYSTICK DOODLE"
 30 INPUT "INPUT MODE ",M
 40 MODE M
 50 X=ADVAL(1) DIV 64
 60 Y=ADVAL(2) DIV 64
 70 DRAW X,Y
 80 TIME=0
 90 REPEAT : UNTIL TIME > 5
100 GOTO 50
```

Listing I

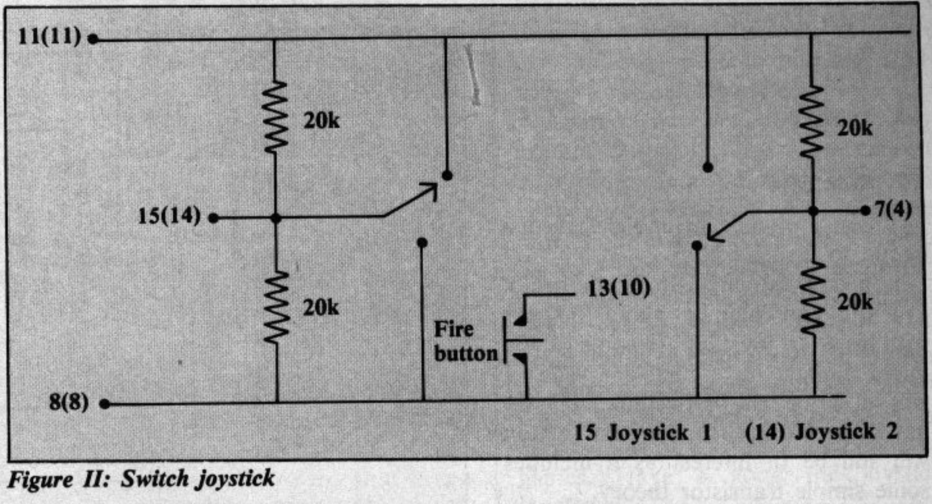

Figure II: Switch joystick

If there are other program lines in the loop which will take up time these lines will not be needed. So try taking those lines out and watch the results carefully. You will see that the points plotted are displaced, as a new position is used for one axis and the old value for the other. This program can be used as the nucleus of a more complicated one.

Try using the INKEY$ function to look at the keyboard each time round the loop and use any key presses for extra functions, like wiping out the screen and changing the colour. You could also scale the numbers by multiplying them by some number so that you cover more of the screen.

You may want to use the X and Y values, not to draw, but to move the gun sights of a space ship or track enemy planes as they appear over the horizon.

You could also make a joystick using switches, which would be sufficient for playing games like Snapper. Again, Radio Spares have a joystick switch assembly (stock No. 337 352) which is shown in photo No. III. It consists of two rotary switches connected together mechanically just as we connected the pots.

As we need to know when the switch is in the centre position as well as when it is pushed to one side, we have to arrange two resistors so that half the voltage is fed to the input (giving a value of about 512) when the joystick is in the centre position, and full voltage, or no voltage, in the other positions (1023 or 0).

```
 10 X=512
 20 Y=512
 30  INPUT " INPUT MODE ",M
 40  MODE M
 50  MOVE X,Y
 60 A=ADVAL(1) DIV 64
 70 B=ADVAL(2) DIV 64
 80 IF A > 800 THEN X=X+2
 90 IF A < 300 THEN X=X-2
100 IF B > 800 THEN Y=Y+2
110 IF B < 300 THEN B=Y-2
120 DRAW X,Y
130 TIME=0
140 REPEAT : UNTIL TIME > 5
150 GOTO 60
```

Listing II

Again the connections for a second joystick are shown in brackets on the diagram in Figure II. Listing II shows how this arrangement could be used to draw pictures. Improvements could be made by making the delay loop speed up when the joystick had been held in the same direction for some time.

Now that would have been the end of the story but for one incident. A friend of mine, Bob Cliff, had been given an Atari joystick and wanted to know how he could connect it up to the BBC Micro to play Snapper. I told him that it was impossible because of the way the joystick was made. Unfortunately I overheard myself saying this and, as my ability to resist a challenge is one of my least developed

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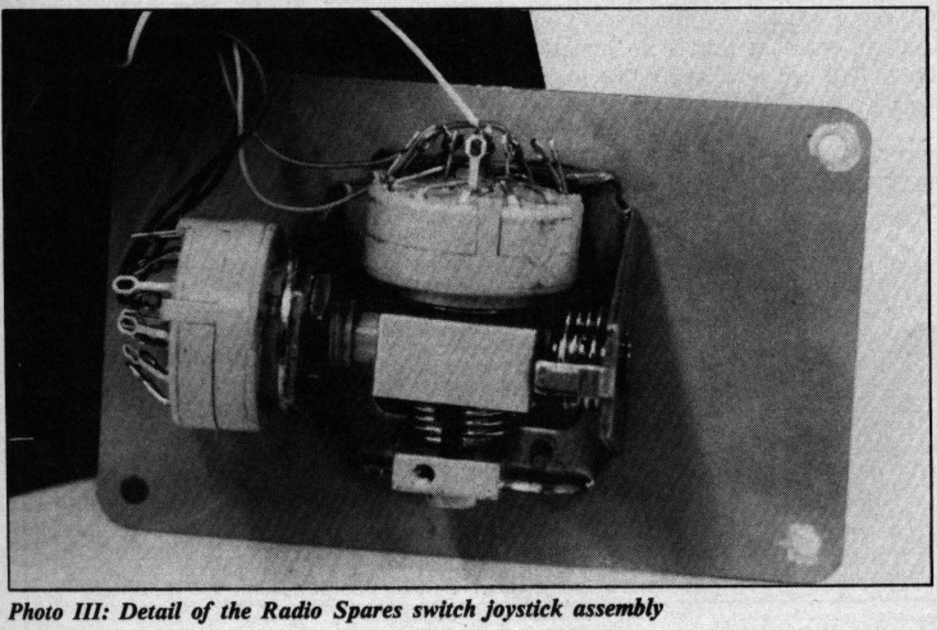

Photo III: Detail of the Radio Spares switch joystick assembly

From Page 39

faculties, I pitched in and designed a circuit to do it.

Bob built the circuit (see photo No. IV) and now happily plays Snapper with his Atari joystick. As some of you might already have such a joystick I will describe the procedure. If you haven't got one then the next section will still be of interest as it includes some simple transistor theory.

The Atari stick is a series of contacts arranged in a circle. The lever makes a connection with any one of these contacts at a time. Also included is a fire button and the whole thing terminates in a 9-way D-type socket. The wiring diagram is shown in Figure III. This is not a configuration that can be wired up like Figure 2 because the lever consists of only one contact and not two.

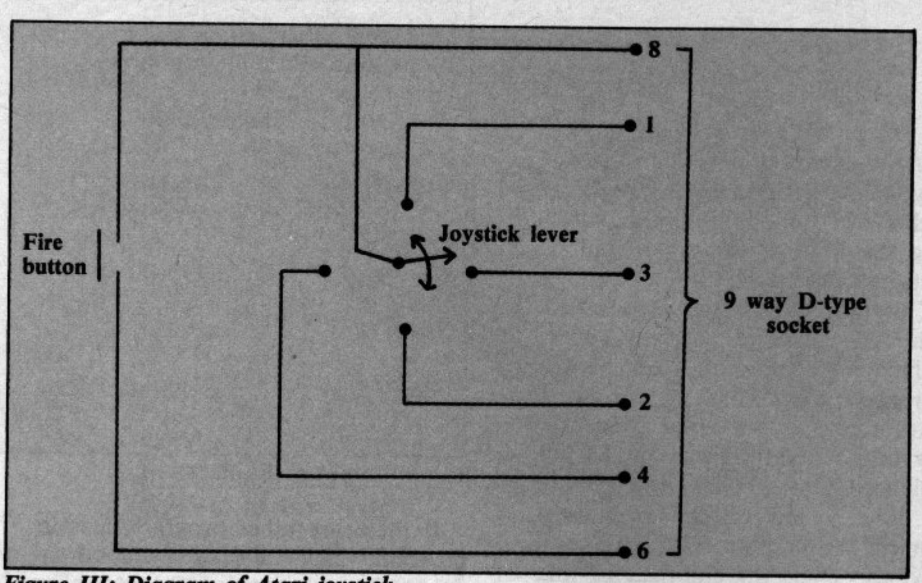

Figure III: Diagram of Atari joystick

In order to see how this problem can be solved we need to see how a transistor can work as a switch. In Figure IVa a transistor is shown with current flowing down the base (Ib), this causes a larger current to flow down the collector (Ic). The amount that Ic is larger than Ib is known as the gain (G) such that:

$$Ic = Ib * G$$

If Ib is large enough then the value of the resistor RL will limit the maximum size of the current Ic. When this happens the transistor is said to be saturated. It stands to reason that when this happens there is no voltage across the collector and emitter of the transistor, and the transistor is said to be "turned on".

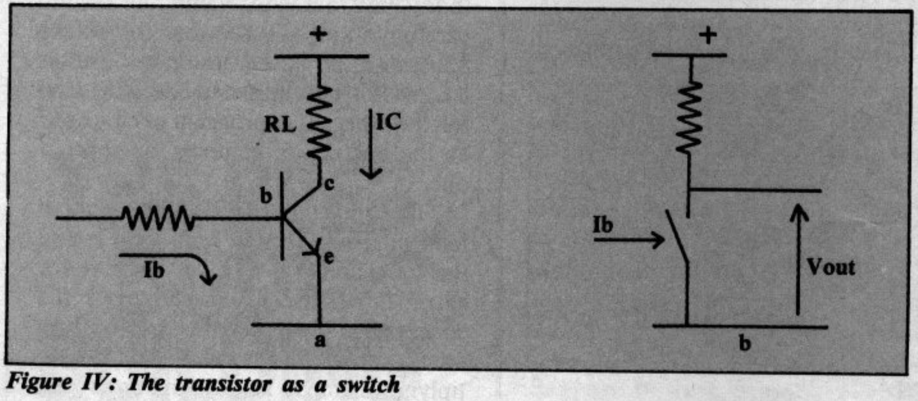

Figure IV: The transistor as a switch

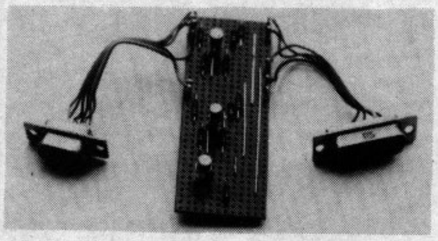

Photo IV: The Atari-to-BBC interface. It could be mounted in a box by the DIY inclined.

Looked at another way (in Figure IVb), base current causes a switch to be closed. When no base current is flowing the switch will be open, thus you get a voltage at the point Vout. You can see that this is an inverting action. We can now apply this to our problem.

The circuit shown in Figure V consists of three parts, the first two of which (T1 and T2) are identical and condition the up/down and left/right outputs of the joystick. The final transistor (T3) deals with the fire button.

The joystick's central lever is connected to the full scale voltage of the A/D converter called Vref (short for reference voltage). When in its central position it does not make contact with either connectors 1 or 2 and so T1 is

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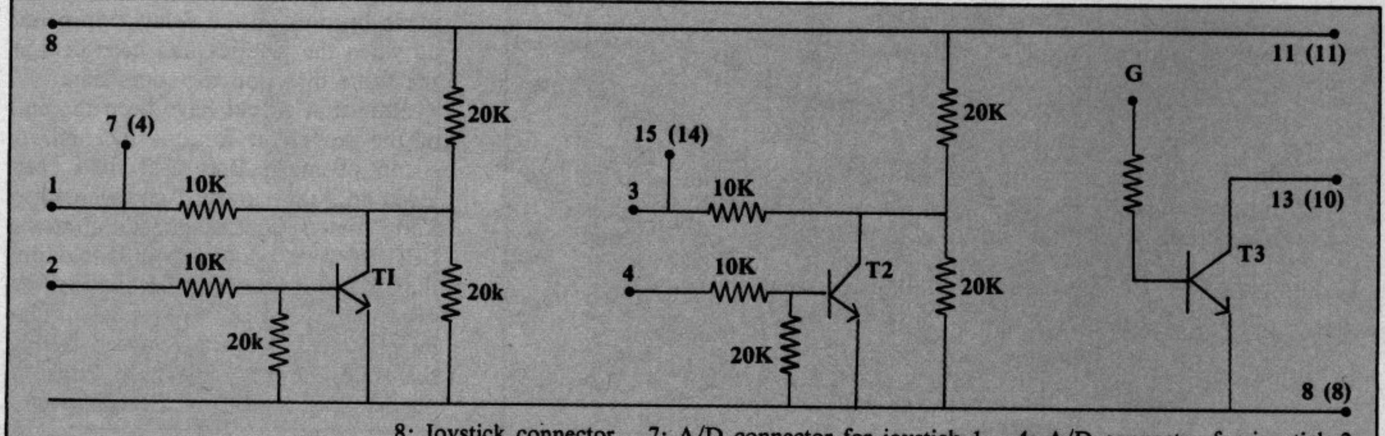

8: Joystick connector 7: A/D connector for joystick 1 4: A/D connector for joystick 2

Figure V: Atari joystick to BBC Micro interface

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off. This means that the voltage at pin 7, the input of the A/D converter, is at half the Vref value due to the potential divider action of the two 20k resistors. This gives a mid-range number with no movement of the joystick.

If the joystick lever is pushed forward it makes a connection with contact 1 and, as this is wired directly to the A/D input, we get the full range number.

If the joystick is pulled back, then Vref is connected to contact 2. This drives current into the base of transistor T1 and turns it on. In turn this shorts out the lower 20k resistor and so puts zero volts on the A/D input, thus giving a low number – actually zero. The circuit is the same for the left/right connections using transistor T2. Finally, transistor T3 inverts the high voltage on connector 6 when the fire button is pressed by acting as a switch.

You may have to read that a few times and follow Figure V closely before you understand it. Sorry, but it don't come any simpler. Again, the resistor values are not very critical and you may use values up to 10k greater than those shown. The transistors also can be any general purpose NPN transistors such as a BC107.

Armed with a joystick, programming can become more interesting, games more exciting and other applications possible. For example, how about making the joystick control the envelope or frequency parameters of the sound synthesiser so you can interact with the noise?

Or you could use a joystick to point to options in a menu and use the fire button to select them. Do not think the applications of a joystick are limited to games. Have a good old joystick joggle.

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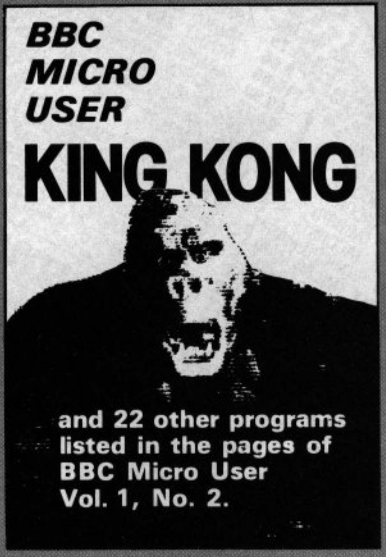
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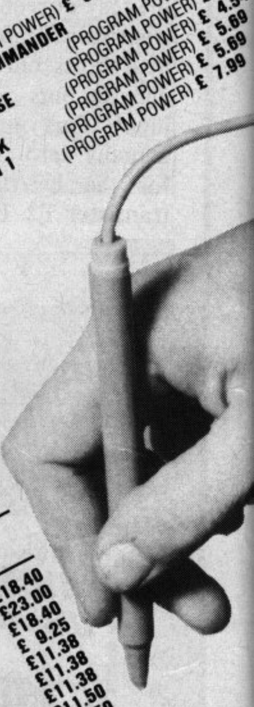

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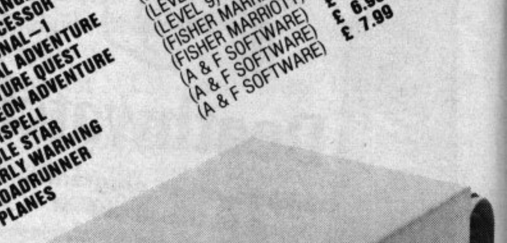

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OSBYTE

WE will be looking this month at the two sets of operating system routines which go under the names of OSBYTE and OSWORD. I shall try to explain how they are organised and how to use them from within Basic and from assembly language.

The OSBYTE routines are those which only deal with a single byte of data at a time, such as reading or writing to the user port or putting characters into or taking them out of the various input and output buffers.

The OSWORD routines, on the other hand, are those which either need to use several bytes to specify how the particular routine is to operate, or which need to pass or return several bytes of data. The idea of this should become clearer once we have looked at the OSBYTE routines and seen how they work.

IN order to see how the OSBYTE routines are arranged, here is a hypothetical case involving Basic in which it is probably easier to see what is happening than it would be if we were dealing with machine code.

Suppose you wanted to supply a user with a set of subroutines which he could call from simple Basic programs, and you wanted to be able to correct if necessary and to improve the routines at a later date.

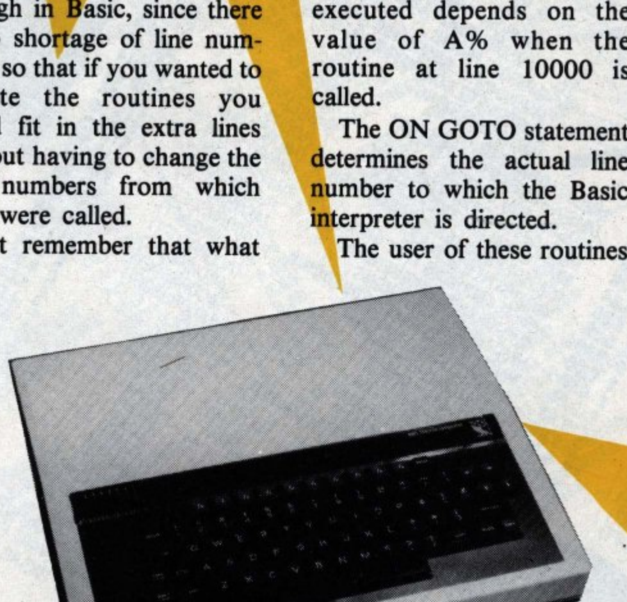
You would want to do it in such a way that the user could simply replace the old routines with the new ones without having to change any of the programs which use them.

How then would you present the routines, and how would you make it easy for the user to use them and for you to update them?

One way would be to say that such and such a routine was called by "GOSUB 10000", the next one by "GOSUB 11000", the next by "GOSUB 12000", and so on.

That would be easy enough in Basic, since there is no shortage of line numbers, so that if you wanted to update the routines you could fit in the extra lines without having to change the line numbers from which they were called.

But remember that what we are trying to do is to see how the machine code routines in the operating system are arranged.



In machine code, if you add any extra instructions in the middle you have to move all the rest down a bit, which changes their addresses.

Let us look therefore at another way of arranging these Basic routines.

Program I illustrates an alternative method. The routines provided consist of lines 10000 onwards, and they are called from the program which the user has written in the first six lines.

This program does actually work. Although it doesn't do anything very spectacular, hopefully it illustrates the point.

The way in which the routines work is that no matter which is being called, the same statement is used namely "GOSUB 10000". Which actual subroutine is executed depends on the value of A% when the routine at line 10000 is called.

The ON GOTO statement determines the actual line number to which the Basic interpreter is directed.

The user of these routines has no need to know what these actual line numbers are, and it does not matter if you change the numbering of the routines when you supply an up-dated version.

All you have to do is to reserve a particular value of A% for each particular routine.

By looking at Program I we can get some idea of how data is transferred to the OSBYTE routines. At line 10 routine number 5 is called, and in this case no data is needed – it simply produces a buzz.

At line 20 the mode change routine is called (routine number 4). This just requires a single piece of data – the number of the mode required – and X% is used to carry this data.

Routine number 3, which is called from line 30, uses two parameters and these are transfered using the variables X% and Y%. The action of this routine is to change the logical colour number, X%, to the actual colour, Y%. In other words it is the VDU 19 command.

The final command which is called in this small program is routine number 1, and it is called from line 40.

As you can see, data is not only passed into this routine, but is also returned from it. Y% is used to carry the answer of the calculation, which comes as a result of raising one number to the power of the other, back into the program which called it.

How then does this relate to the OSBYTE routines? It is no coincidence that we have used A%, X% and Y%, because A, X and Y are the letters used to represent the three registers in the 6502 microprocessor.

A is the accumulator, and X and Y are known as the index registers. When you jump from Basic into a machine code program by using the CALL command, Basic takes the lowest byte of each of the integer variables A%, X% and Y% and puts them into the A, X and Y registers respectively before jumping to the address specified in the

---

Paul Beverley is lecturer in electronics at Norwich City College.

PAUL BEVERLEY explains the intricacies of the BBC Micro's two operating system routines

```
   10 A%=5:GOSUB 10000
   20 A%=4 : X%=6 : GOSUB 10000
   30 A%=3 : X%=0 : Y%=4 : GOSUB 10000
   40 A%=1 : X%=2 : Y%=3 : GOSUB 10000
   50 PRINT "The cube of ";X% " is ";Y%
   60 END
   70
10000 ON A% GOTO 10200, 10600, 11000, 11400, 11800, 12200
10100
10200 REM Routine 1 - Power calculation
10300 Y%=X%^Y%
10400 RETURN
10500
10600 REM Routine 2 - This routine is not available
10700 REM before version 1.0!!!!!
10800 RETURN
10900
11000 REM Routine 3 - Colour change
11100 VDU19,X%,Y%,0,0,0
11200 RETURN
11300
11400 REM Routine 4 - Mode change
11500 MODE X%
11600 RETURN
11700
11800 REM Routine 5 - Buzz!
11900 VDU7
12000 RETURN
12100
12200 REM Routine 6 - For future expansion
12300 RETURN
```

Program I

CALL.

Programs II, III and IV show one way in which you could CALL some of the OSBYTE routines.

Programs II calls OSBYTE routine 0 which interrupts the processor and produces the operating system title before returning you to Basic.

```
10 OSBYTE=&FFF4
20 A%=0
30 CALL OSBYTE
```

Program II

Program III is an example of passing a variable into the X register. The value given for X% in this case is the time in centiseconds of the auto-repeat on the keys.

In the third example (Program IV), two variables are passed. Unfortunately, the routine it uses is only available in operating systems 1.0 onwards, so if you still only have the 0.1 version you will not be able to try it out.

```
10 OSBYTE=&FFF4
20 A%=11
30 X%=1
40 CALL OSBYTE
```

Program III

There are various buffers on the BBC machine, such as the keyboard, the speech input, the sound input, or the RS423, where characters can be stored until the processing software is ready to deal with them. The purpose of this routine then is to add extra bytes into these buffers.

The particular buffer is selected by the value of X% and in this case we have chosen the keyboard buffer by setting X%=0.

The value of Y% is the Ascii code of the character which is to be inserted. Any characters which are thus inserted will be dealt with as if they had been typed in from the keyboard.

Thus as soon as the program itself has finished running, the Basic monitor looks in the keyboard buffer to see if any characters have been typed in during the running of the program.

```
 10 OSBYTE=&FFF4
 20 A%=138
 30 X%=0
 40 Y%=78
 50 CALL OSBYTE
 60 Y%=69
 70 CALL OSBYTE
 80 Y%=87
 90 CALL OSBYTE
100 Y%=13
110 CALL OSBYTE
```

Program IV

It finds the characters which you have put in and prints them out on the screen, and since the last character is a carriage return (13), it acts on them.

If you run this you will see that it is an auto-destruct program! However you can, of course, regain it by typing OLD.

```
10 *FX138,0,78
20 *FX138,0,69
30 *FX138,0,87
40 *FX138,0,13
```

Program V

If you want to use some of the OSBYTE routines without going into machine code, then provided the routines do not expect data to be returned you can use the *FX command.

If we translate Programs II, III and IV using the *FX command, they become very simple. For example, Program II becomes simply *FX 0, and Program III reduces to *FX 11,1.

Program V is the equivalent of Program IV when turned into *FX form. As you should be able to see by comparing Programs IV and V, the first parameter after the FX is the routine

→

OSWORD

From Page 45

number, that is the contents of the accumulator. The next two are the X and Y registers respectively.

If no parameter is specified in the FX call it is assumed to be zero, so if you want, for example, to use *FX 12,0 to restore the auto-repeat time to its default value you could just say *FX12, since the X value is then assumed to be zero.

If you are wanting to use OSBYTE CALLS from within machine code you have to use the load immediate (LDA#) command as shown in the example in Program VI. Once again, this program produces exactly the same effect as Programs IV and V.

```
 10 DIM CODE 100
 20 OSBYTE = &FFF4
 30 P%=CODE
 40 [
 50 LDA # 138
 55 LDX # 0
 60 LDY # 78
 70 JSR OSBYTE
 80 LDA # 138
 85 LDX # 0
 90 LDY # 69
100 JSR OSBYTE
110 LDA # 138
115 LDX # 0
120 LDY # 87
130 JSR OSBYTE
140 LDA # 138
145 LDX # 0
150 LDY # 13
160 JSR OSBYTE
170 RTS
180 ]
190 CALL CODE
```

Program VI

Exactly what each of the OSBYTE calls does is too complex to describe here, but I have tried to give at least some idea of the way in which they can be called. These commands are summarised in the User Guide pages 418 and 419, and they are explained in detail in the rest of that chapter.

The OSWORD routines are similar to the OSBYTE ones in that they are selected by the number placed in the accumulator.

They are different in that they transfer more than the two bytes of data that can be held in the X and Y registers. For the OSWORD routines, the X and Y registers are used to carry the address of an area of memory which is used to store the data which is being transferred into or out of the routine.

This area of memory is known as the parameter block, and X carries the low byte of the address, and Y the high byte.

The example given in Program VII shows how this works. It involves OSWORD routines 4 and 5, which are to do with writing and reading the interval timer.

***FX**	*Call one of the write-only operating system routines.*
***BASIC**	*Switch back to Basic.*
***CAT**	*Do a catalogue of the current file system.*
***CODE**	*Does anyone know what this one does?*
***EXEC**	*Take a file into the input stream as if it came from the keyboard.*
***HELP**	*Give information on what is in the sideways ROM sockets.*
***KEY**	*Program a function key.*
***LOAD**	*Load data straight into memory.*
***LINE**	*Does anyone know what this one does?*
***MOTOR**	*Switch cassette motor on or off.*
***OPT**	*Set up various options to do with the filing systems.*
***RUN**	*Load and run a machine code program.*
***ROM**	*Switch to the ROM file system.*
***SAVE**	*Save an area of memory to the file system.*
***SPOOL**	*Send to the file a copy of all that goes to the output channel.*
***TAPE**	*Select the tape file system.*

TABLE I – List of operating system commands. These were read directly out of the OS 1.2 ROM using a machine code monitor. Two of the command names are not mentioned in the User Guide, but presumably must do something.

***DISK**
***NET**
***TELESOFT**
***TERMINAL**

TABLE II – These commands are mentioned in the User Guide but are not found in the OS ROM since they refer to software which will have to be put in the sideways ROM sockets.

You may be familiar with the TIME command in Basic, which uses a centisecond clock, and can be either written or read from Basic. The value of TIME is referred to as the elapsed time clock, and can be accessed by using OSWORD routines 1 and 2.

The interval timer, however, is not affected by, and does not affect, the value of TIME, as this program illustrates. The idea is that the routine labelled "write" from lines 50 to 100 is called in order to write zero into the interval timer.

The address of the parameter block is &D00, and at line 90 at the number 0 is written into that area of memory.

When the operating system starts into this routine it looks in the X and Y registers to find where the data is stored.

It then takes that data and puts it into the interval timer memory locations.

At line 210 the value of TIME is recorded and then printed out, and after an arbitrary waiting time produced by asking the user for an input at line 230, the value of the interval timer is read at line 240 by using the "read" routine.

The TIME is again recorded and the difference between the first value of TIME and the second is printed out. This can be

```
 10 DIM CODE 100
 20 OSWORD=&FFF1
 30 P%=CODE
 40 [
 50 .write
 60 LDX#0
 70 LDY#&0D
 80 LDA#4
 90 JSR OSWORD
100 RTS
110
120 .read
130 LDX#0
140 LDY#&0D
150 LDA#3
160 JSR OSWORD
170 RTS
180 ]
190 !&D00=0
200 CALL write
210 T%=TIME
220 PRINT T%
230 INPUT WAIT
240 CALL read
250 T1%=TIME
260 PRINT T1%
270 PRINT T1%-T%
280 PRINT !&D00
```

Program VII

compared with the value of the number recorded in memory location &D00 which had been read from the interval timer.

These two should, of course, be the same, though there is occasionally a difference of one centisecond.

As you will have gathered, there are various levels at which the operating system software can be used. DRAW, PLOT, SAVE and LOAD, for example, all use the operating system routines, and yet they are keywords specific to Basic.

Any function which deals with input or output such as the keyboard, vdu, filing systems, printers etc uses the operating system routines. From within Basic, or any other language, you need to be able to set the operating system to do various jobs and so instead of adding extra commands to the language, the common ones are made available as what are called command lines.

In Basic these are commands such as *CAT which all begin with an asterisk. *LOAD and *SAVE are the two which you may well have used.

Again, they are not Basic commands, that is they are not the same as SAVE and LOAD.

The difference is that they allow you to load and save data to and from specific memory locations, and the commands have to be followed by data about the particular command – *SAVE "DATA" 3000 4000, saves the block of 4k of data from &3000 to &4000 under the file name "DATA".

Other such commands include *SPOOL and *EXEC, which are concerned with transferring text to and from the filing system (tape, disc or Econet).

Whenever a command line is encountered – that is, from Basic, any line starting with an * – it is first passed to the operating system to see if it is one of the commands which it is supposed to recognise. A list of these is given in Table I.

If the operating system itself does not recognise it it compares it with all the commands available in each of the service ROMs in the sideways ROM sockets.

If it cannot find it there it looks in the serial ROMs on the cartridge input (that is the funny looking hole on the left hand side of the keyboard).

Then finally, if you are on disc or Econet, it looks to see if there is a file of that name, and if there is, it loads and executes it before returning to Basic at the line following the one from which it was called.

Most of the operating system commands given in Table I are discussed in more detail in the User Guide on pages 416 and 417. Some of them, such as *TV and *OPT, are simply OSBYTE routines but with a name attached to them rather than with just a number – to make them easier to use.

The same effect, for example, as *TV 255 can be obtained by using OSBYTE CALL number 244 followed by the number 255, that is you would say *FX244, 255.

(Two routines have been discovered by digging around in the operating system ROM, but so far we have no idea what they do, if anything!)

As you can see, the operating system of the BBC Micro is very complex. But when you consider that there must be around 13-14k of machine code routines in the operating system ROM, it's hardly surprising that it takes quite a while to sort out how it all works.

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Part Three of MIKE BIBBY'S introduction to programming

String along .. and pick up some

WE saw last month how to write our own programs, however primitive. Now we'll look at some ways of improving them. I don't guarantee that you'll be able to produce spectacular programs by the end of this article, but you will certainly be well on the way to an understanding of Basic.

First, though, let's recap a little: We saw last month that a Basic program consists of a numbered sequence of instructions to the computer.

To enter one of these instructions we simply type the correct line number, followed by the appropriate Basic keyword, then press Return.

As we discovered, because of the line number, the BBC Micro doesn't do what you tell it immediately, but remembers it as part of the program.

To see all the instructions in a program, we type:

```
LIST     [Return]
```

To actually get the BBC Micro to carry out the sequence of instructions we type:

```
RUN     [Return]
```

To clear a program from memory (and we should do this before entering a new program), we use:

```
NEW     [Return]
```

We saw that we tended to enter line numbers in steps of 10 to allow us to fit in other instructions between them if necessary. Also we found that we could replace a line with a better version by simply giving the new version the line number of the old one.

Finally, to delete a line completely, we simply type the line number and press Return.

Program I is the one we started with last month. Before we continue, type it in and run it, to make sure you know what's going on:

```
10 PRINT "PROGRAMMING"
20 PRINT "IS"
30 PRINT "EASY"
```

Program II is another way of achieving exactly the same output. Type it in and try it:

```
10 A$= "PROGRAMMING"
20 B$ = "IS"
30 C$ = "EASY"
40 PRINT A$
50 PRINT B$
60 PRINT C$
```

Apart from its being an incredibly long-winded way of doing things, what else is going on?

Well, as you will recall from the first article in this series, the words inside quotes are known as strings – because the computer simply remembers them as strings. That is, it considers HAMSTER as H, followed by A, followed by M and so on, with no idea of the word's meaning.

I don't think that it takes all that much imagination to see that when your computer is printing a lot of output, you might be using the same string rather a lot.

For example, in a business letter you might use the name of the company fairly frequently – for example, BBC for British Broadcasting Corporation. The BBC Micro's Basic allows us to use much the same idea, but more as labels than abbreviations.

For instance, in line 10 of the above program we have labelled the string "PROGRAMMING" with the label A$.

In computer terms, we have assigned to A$ the value "PROGRAMMING".

All this means is that from now on wherever I want to use "PROGRAMMING" in my program, I can replace it with A$. So line 40, which is

```
40 PRINT A$
```

causes the micro to print out "PROGRAMMING".

Admittedly in this example this technique of labelling doesn't save much space or effort, but if the program uses the word "PROGRAMMING" 100 times, there would be a substantial saving in using A$ instead of the string itself.

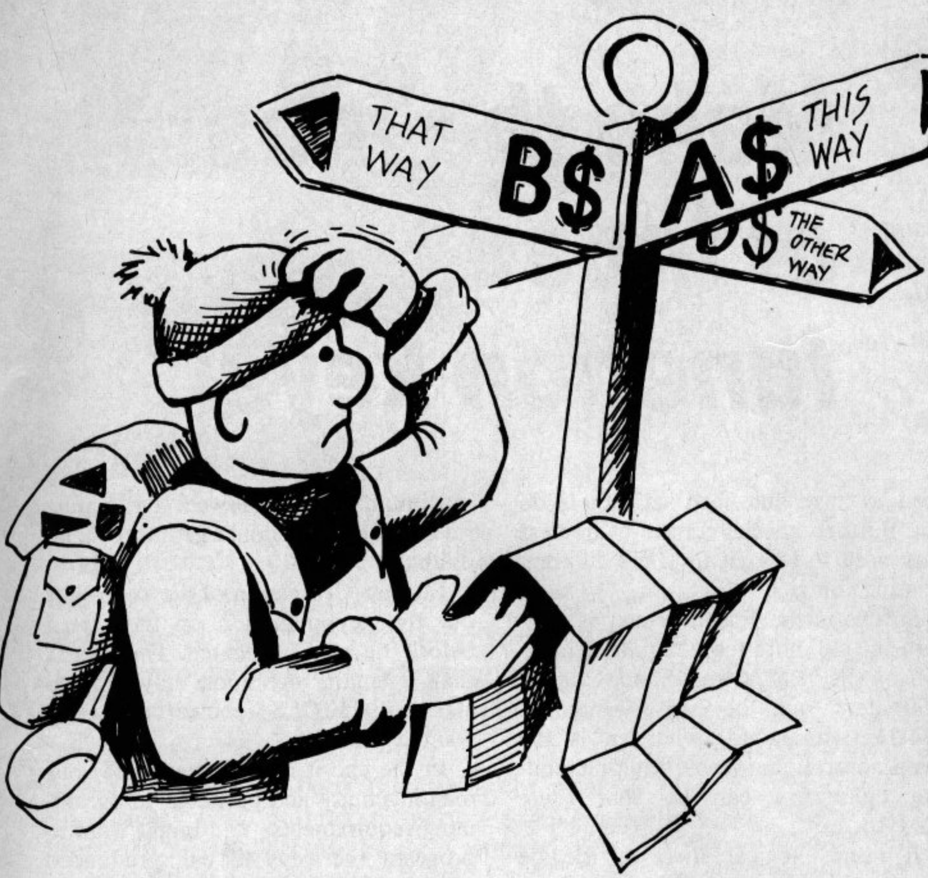
Similarly, line 20 causes B$ to label "IS" and line 30 labels "EASY" with C$, so that lines 50 and 60 give the appropriate printout.

Notice the following points:

- We have chosen our labels so that they consist of a letter of the alphabet followed by the "$" sign. Actually, we don't have to restrict ourselves to just one letter, as we shall see, but our label must end with the "$" sign, since this warns the computer that we are labelling a string. (We'll see later how to label other things.)
- While I used A$ for the first label, B$ for the second and C$ for the third, this was totally arbitrary on my part – labels don't have to follow alphabetic or any other kind of order.
- Although we use an equals sign ("=") to connect the label with what it is labelling, it is safer, as we shall see, not to think of it as an equals sign – think in terms of A$ becomes "PROGRAMMING" rather than A$ equals "PROGRAMMING".
- We must have the label on the left and what is labelled on the right of the equals sign. A line such as:

```
10 "PROGRAMMING" = A$
```

just does not make sense to the BBC



handy jargon

Micro. Try it for yourself!

- When labelling we put the string inside quotes, as we did previously when using the PRINT statement to print out strings. So line 10 reads:

```
10 A$ = “PROGRAMMING”
```

From now on A$ completely replaces “PROGRAMMING”, quotes and all, so that when we say

```
PRINT A$
```

we don't have to use any quotes – they're already there, implicit in the label A$.

Now when we label a string the label refers to whatever is inside the quotes, including spaces, as you will see if you run Program III:

```
10 REM *** PROGRAM III ***
20 MODE 6
30 A$ = “TEST”
40 B$ = “ TEST”
50 C$ = “  TEST”
60 D$ = “    TEST”
70 PRINT A$'B$'C$'D$'
80 PRINT A$;B$;C$;D$
90 PRINT “01234567890123456789
   0123456789”
```

Notice that our punctuation, semicolons and apostrophes, works for labelled strings just as it worked on its own.

Notice also that we have introduced a new Basic keyword in line 10 – REM. We use REM for REMark, which is short to add comments or headings to our programs.

When the BBC Micro encounters REM in a line it ignores everything else after it on the same line. This means we can write whatever we want after REM (providing it is on the same line) without fear of the micro giving us an error message – the BBC Micro doesn't “read” the line beyond the REM.

If we use REM to prefix our comments on the program we can annotate our program. Certainly each main subdivision should have one or more REM statements explaining what is going on.

Since the BBC Micro ignores the contents of REM statements, you could leave them out of your program entirely and it will work as effectively. However it is good programming practice to include them.

In the example below I have used a single REM at the beginning of the program, as it is so short. Bear in mind however, that REM can appear on any line in a program.

Now for some jargon. From now on we shall refer to our labels as variables. Don't be put off by the mathematical sound of that – they are still just labels! And instead of saying we are labelling, we say we are assigning, as we have mentioned previously. The actual string involved is known as the value of the variable. So

```
A$ = “TEST”
```

reads “the string variable A$ has assigned to it the value ‘TEST’”. The actual act of giving a variable a value is called an assignment.

To return to the world of actual programs, you can mix and match string variables and actual strings however you want. Program IV illustrates the point:

```
10 REM ***PROGRAM IV***
20 MODE 6
30 A$ = “MY NAME IS”
40 B$ = “ MIKE”
50 PRINT A$; B$
60 PRINT “MY NAME IS”; B$
70 PRINT A$; “ MIKE”
```

Notice the space of the beginning of the string assigned to B$ – you need this otherwise the output looks rather odd. Leave it out if you don't believe me!

As we saw last month, a semi-colon at the end of a line causes the next output to start immediately after the last and not on a new line – as it would do in the absence of the semi-colon. That is, it “glues” the strings together.

The internal semi-colons of lines 50, 60 and 70 do much of the same, “gluing” varables to strings, etc.

While this is grammatically correct Basic, the BBC Micro assumes (unless you tell it otherwise) that variables and strings mentioned in the same PRINT statement are meant to be output continuously on the same line. To prove this run Program IV omitting all the semi-colons.

Also, while we're on the subject of grammatical propriety, when we're assigning variables we should use the LET statement. So line 40 should read

```
40 LET B$ = “MIKE
```

As you're already discovered, we can omit LET altogether.

- *Next month, more on variables and INPUT – which opens the door to effective programming.*

Make the most of those function keys

THE User Guide contains some suggestions for using the function keys. What they amount to is to set up keys to change to MODE7 and LIST the program, to enter OLD and then RUN, and finally, to print the contents of part of memory (Page 411).

Now many other features spring to mind as being suitable for the function keys. Clearly not much advantage is gained from using them as shorthand for keywords, since there are already comprehensive abbreviation facilities, such as P. and N. So here is a brief description of some areas that seem "functionable", starting with two useful BBC functions, EVAL and ("Hex").

Designed with the object of allowing a user to enter a whole expression while a program is running, that is, to show different graphical representations of various functions, EVAL can be used in a function key to convert the computer into a simple calculator.

The key is set up to accept input of a string expression from the user, which is then EVALuated and printed. Instead of having to type a PRINT command, the user merely types, for example:

34*PI*2.3↑2

or

SIN(RAD(57.3))

Further, since the EVAL function also understands hex input, the facility provides a means of converting hex to decimal. All the user does is to type:

&300

which will be evaluated to its decimal equivalent.

The reverse process, that of obtaining hex from decimal, is readily achieved by use of the ~ command, which appears to be wholly undocumented in the User Guide, although it is used without explanation in the assembler section. Thus, if a function key is set up to PRINT ~N, where N is input by the user, the dec to hex facility is instantly available.

The memory map is set out on Pages 500 and 501 of the Guide. To find the length of your program, subtract PAGE from LOMEM. The space left is the gap between LOMEM and HIMEM. The function keys can readily be set up to show all or part of the memory usage, at the touch of a key.

One of the poorly documented features of the Guide is how to get your printer to function properly. It is common knowledge that some printers need to have auto-feed set, others do not. Further, special control characters may need to be sent to select different printing fonts.

So far as the Epson printer is concerned, the auto-feed requirement is met by the *FX6,0 command. Control characters can be sent using the VDU1,n command (where n is the Ascii control character). Multiple control characters can be sent using VDU1,n,1,m.

It seems logical then to include printer set-up commands in the function keys.

In order to get paged listing, rather than scrolled listing, the control character N has to be sent before the LIST (and after any MODE change). The two different commands can be included in the function keys.

The short set-up program shows examples of the above. The key sequence is as follows:

KEY 0: Turn printer off.
KEY 1: Turn printer on.
KEY 2: Printer width 75, normal font.
KEY 3: Printer width 135, condensed font.
KEY 4: Calculator (including hex to dec).
KEY 5: Dec to hex
KEY 6: Prog size.
KEY 7:
KEY 8: Paged LIST
KEY 9: Scrolled LIST

Although it doesn't say so in the Guide (it appears that BBC hitchhikers are expected to fall into the occasional dark hole as they progress through the galaxy), there is a memory limit to the function keys.

If you try and cram too much into the key definitions you will get a mysterious BAD KEY error message. This may have nothing to do with your lack of programming skill, but simply mean that you have gone over the memory allocation for the keys.

The sample program is about the maximum length allowed. By getting rid of spaces you could get more in, no doubt.

Further, depression of the key prints out the key definition on the screen before the key is executed. This means that a lengthy definition may have to start with a CLS to clear away unwanted printout.

In the end it is all a matter of your own ingenuity and particular programming requirements. You might want to program the keys to call pre-loaded machine code routines, or print out the time and date, or provide extensive renumbering facilities. Over to you!

```
   10  *KEY0¦M
   20  *KEY1¦M
   30  *KEY2¦M
   40  *KEY3¦M
   50  *KEY4¦M
   60  *KEY5¦M
   70  *KEY6¦M
   80  *KEY7¦M
   90  *KEY8¦M
  100  *KEY9¦M
  110  REM PRINTER KEYS 0=OFF 1=ON
 2=NORMAL/75 3=CONDENSED/135
  120  *KEY0 ¦C
  130  *KEY1 ¦B
  140  *KEY2 WIDTH 75: VDU1,18:
 *FX6,0 ¦ M
  150  *KEY3 WIDTH 135: VDU1,15:
 *FX6,0 ¦M
  160  REM SIMPLE CALCULATOR FACILITY
  170  *KEY4 CLS:P.'':REPEAT INPUT
 "EXPRESSION "F$:P.;EVAL(F$):UNTIL
 FALSE ¦M
  180  REM DEC TO HEX
  190  *KEY5 CLS:P.'':REPEAT INPUT "DE
 CIMAL "F$:P.;~VAL(F$):UNTIL FALSE ¦M
  200  REM PROGRAM SIZE
  210  *KEY6 CLS:P.''LOMEM-PAGE ¦M
  220  REM PAGED MODE 7 LIST
  230  *KEY8 MODE 7 ¦M ¦N LIST ¦M
  240  REM MODE 7 LIST
  250  *KEY9 MODE 7 ¦M LIST ¦M
```

WIN!

- ★ *One 40-track 100k Cumana disc drive, value £199.*
- ★ *One connecting cable to link the drive to your BBC Micro.*
- ★ *One copy of "Using Floppy Disks with the BBC Microcomputer."*

– They all go to the winner of this challenging contest.

THIS month's contest should prove a worthy test of your programming abilities. And we've a prize that should certainly speed up your future programming – a high quality Cumana disc drive with its own independent power supply.

With it comes a book that strips the mystery off how drives work, and takes you on a complete guided tour of the BBC's Disk Filing System (DFS).

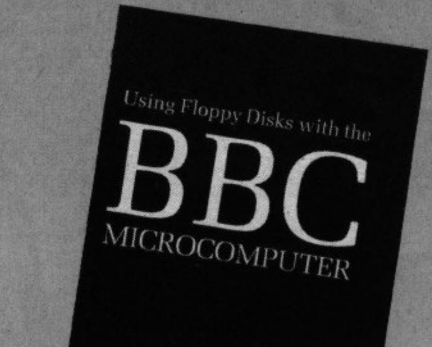
Now for the competition itself . . .

Sean Overend's article on the opposite page tells you what we mean by a program that sets up the User Defined Function Keys. Every programmer seems to have his personal way of setting up the keys – Paul Leman details his in the Mode 7 article on Page 18.

All you have to do is to present us with your program to set up the function keys – the most original and creative program wins!

Send us your entries on cassette, accompanied by a listing – with your name and address clearly marked on both – before June 30. (If you want your cassette returning please enclose a stamped addressed envelope, otherwise we shall donate it to a school.)

Each entry must include the entry form printed below – or a copy of it.



★ ★

Leeds reader wins colour monitor

WE had many hundreds of entries for our first competition in the March issue of BBC Micro User, and while only a handful managed to recreate the original photograph, most entries were very close indeed – close enough to give Percival a headache sorting them out!

Programming was to an extremely high standard, and it was obvious that many of you had gone to a great deal of trouble.

Perhaps the most remarkable aspect was the large variety of execution times – the longest took just under an hour!

Eventual winner was Stuart Stoney of Leeds, and the superb Microvitec monitor presented by Silicon Express is on its way to him.

Those who didn't manage to crack the program will be glad to know that Percival has found his original. (He actually tried to sneak it into the competition but the editor spotted it.) We present it here with no explanation, as he's forgotten how it works.

```
 10 R%=300
 20 DIMX(100),Y(100)
 30 MODE1:VDU19,0,4;0;
 40 VDU 29,640;512;:MOVE
    R%,0
 50 FOR I%=0 TO 100
 60 Z=2*PI*I%/100
 70 X(I%)=R%*COSZ:Y(I%)=
    R%*SIN Z
 80 NEXT
 90 FOR A=0 TO PI STEP 0.1
100 ANGLE=COS A
110 FOR I%=1 TO 100
120 DRAW X(I%),Y(I%)*ANGLE
130 GCOL0,I%MOD3+1
140 NEXT
150 NEXT
```

★ ★

Your FREE entry form

My cassette and listing for the BBC disc drive competition is enclosed, plus a stamped addressed envelope for its return.

Name ....

Address ....

....

....

Tel: No. ....

POST TO: Disc Contest, BBC Micro User,
Europa House, 68 Chester Road, Hazel Grove,
Stockport SK7 5NY.

AIR STRIKE!

Fly low and fast to zap the aliens

A fast and furious arcade game by Jonathan McFarlane

HOVERING over the mountains of the enemy planet, a ship appears on the horizon. Move in, line up your sights and fire ...

Air Strike is an arcade-style game for the 32k BBC machine. The aim of the game is to shoot as many aliens as possible before they get you.

There are four different types of nasties, two on the ground firing up at you and two airborne. A description of them and how they attack is given in the instructions along with directions for movement of your craft.

There are three levels of play (1 being the hardest and 3 the easiest) to

choose from, after which a short tune is played and the screen is set up. On level one your spaceship is more difficult to control and the aliens approach more rapidly, firing more accurately and more often. A bonus ship is awarded for every 1000 points scored.

The game ends when you lose all your lives, but if your score is high enough you can enter your name in the top five high score table. During the game your score, ships remaining and the high score are displayed and updated whenever necessary. The game incorporates realistic sound effects, graphics, colour and explosions.

A few hints and believe us, you'll need them:

☐ Stick to level 3 until you master the controls, because level 1 requires the quickest of reflexes and a lot of skill.

☐ Try to keep low, in order to dodge flak and missiles fired at you from ground bases.

☐ Don't get too near the top or bottom, as you might explode.

☐ Don't go too fast as you could lose control of the craft and crash.

☐ On level 1, avoid the mother ship, which is deadly.

The program calls two main routines, one to move your ship and one to move the alien, which in their turn call other procedures to do such things as check for crashes and update scores.

The program uses integer variables – the ones followed by a % sign – to speed up the program. For the same reason multi-statement lines and procedures are used.

Note that BBC owners with the disc interface might find that they do not have enough memory to type in the program. This should be remedied by leaving out all unnecessary spaces.

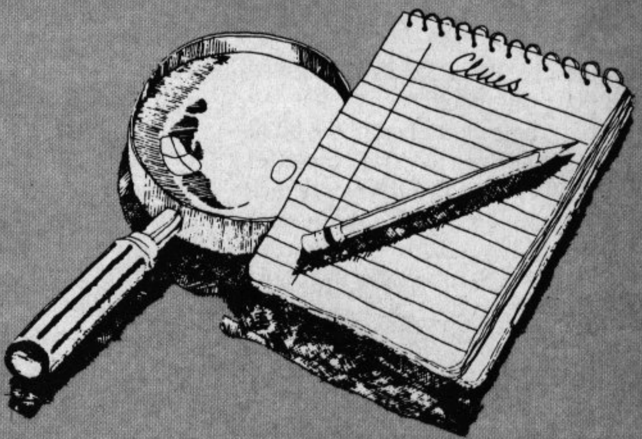
```
    0 REM AIR STRIKE MK VII
    1 REM Jon McFarlane 1983
    2 ONERRORPROCCOL(2):CLS:VDU4:GOTO7
    3 DIMN$(5),HH%(5):FORN%=1TO5:N$(N%)=
"Beeb 3":HH%(N%)=100:NEXT
    4 VDU23,230,0,64,96,112,127,63,31,0,
23,231,0,0,96,144,248,255,248,0,23,232,0
,7,63,114,114,63,7,0,23,233,0,224,252,78
,78,252,224,0,23,234,129,66,36,24,24,36,
66,129,23,236,0,16,16,16,248,172,252,252
,23,237,0,0,0,49,25,13,7,3
    5 MODE1:VDU23,238,0,0,0,140,152,176,
224,192,23,239,219,219,126,126,60,60,60,
24,23,235,0,0,64,64,67,66,67,67,23,226,8
5,170,85,170,85,170,85,170:ENVELOPE1,1,1
,-1,1,1,1,1,126,0,0,-5,100,0
    6 A$=CHR$230+CHR$231:B$=CHR$232+CHR$
233:C$=CHR$234:ENVELOPE2,10,0,0,0,10,10,
10,126,-5,-5,-5,110,0:ENVELOPE3,7,-10,20
,-10,1,1,1,0,0,0,-127,100,0:BBX=-10:AAX=
0
    7 VDU23;8202;0;0;0;:PROCINST
    8 BS%=0:AS%=0:S%=0:A%=50:B%=500:T%=0
    9 LIV%=3:VDU4:PROCCOL(7):COLOUR130:C
OLOUR0:CLS:INPUT''''''''''"Which level(1
-3)",LEV%:CLS:IFLEV%<1ORLEV%>3THEN9
   10 PROCTUNE:VDU5:ONLEV%GOSUB96,97,98
   11 VDU23;8202;0;0;0;:PROCTERR
   12 R=RND(4):ONR GOSUB27,28,29,30
   13 BON%=RND(10):IFBON%=1PRINTTAB(0,3)
"Double points!!":BON%=2 ELSEIFBON%=3
PRINTTAB(0,3)"Mystery points!!":BON%=
RND(4)ELSE BON%=1
   14 GCOL4,3:MOVEA%,B%:PRINTA$:IFR<3
MOVEC%,D%
   15 IFR=2PRINTB$:SOUND3,1,20,255ELSEIF
R=1PRINTC$:SOUND3,3,100,255
   16 GOTO19
   17 IF AL=0GOTO36
   18 GOTO16
   19 GCOL4,0:MOVEA%,B%:PRINTA$:IFINKEY
(-66)BS%=BS%+1ELSEIFINKEY(-98)BS%=BS%-1
ELSEIFINKEY(-1)AS%=AS%+6
   20 IFAS%>90 AS%=90 ELSEIFAS%<MS% AS%=
MS%
   21 IFBS%>10 BS%=10 ELSEIFBS%<-20 BS%=
-20
   22 B%=B%+BS%:A%=A%+AS%:AS%=AS%-1
   23 IFA%>=1250THEN11ELSEIFB%<=0ORB%>=1
000 THEN60 ELSEIFA%>1250THENN%=31:GOTO17
   24 GCOL4,3:MOVEA%,B%:PRINTA$:IFINKEY
(-74)GOTO32
   25 IFA%<C%+32ANDA%>C% ANDB%-16<D% AND
B%-16>D%-32 THEN60
   26 GOTO17
   27 C%=1200:D%=RND(500)+100:RETURN
   28 C%=1200:D%=RND(500)+100:RETURN
   29 GOSUB31:MOVEC%,D%:PRINTCHR$235;
CHR$236:RETURN
```

→

AIR STRIKE!

```
   30 GOSUB31:MOVEC%,D%:PRINTCHR$237;
CHR$238:RETURN
   31 C%=1110:D%=X+33:GCOL0,1:RETURN
   32 MOVEA%+64,B%-16:GCOL4,3:DRAW1280,
B%-16:SOUND1,-15,200,1:SOUND2,-15,205,1:
GCOL4,0:DRAWA%+64,B%-16:IFB%-16<D% AND
B%-16>D%-32 ANDA%<=C% THEN33ELSEGOTO17
   33 IFAL=1ENDPROC
   34 *FX15
   35 PROCSC:PROCEXP:GOTO17
   36 ON R GOTO40,37,46,44
   37 GCOL4,0:MOVEC%,D%:PRINTB$:C%=C%-
CR%:IFD%<B% D%=D%+CR% ELSE D%=D%-CR%
   38 GCOL4,3:MOVEC%,D%:PRINTB$:IFRND(FR
%)=1 AND C%>A% THENPROCAFIRE
   39 GOTO16
   40 GCOL4,0:MOVEC%,D%:PRINTC$:IFC%<A%
THENC%=C%+CR% ELSEIFC%>A%THENC%=C%-CR%
   41 IFD%>B% D%=D%-CR% ELSEIFD%<B% D%=
D%+CR%
   42 GCOL4,3:MOVEC%,D%:PRINTC$:IFC%<A%
+100 AND C%>A%-100 AND D%<B%+100 AND D%>
B%-100 THEN 94
   43 GOTO16
   44 IFB%<D%THENGOTO16
   45 MOVEAAX,BBX:VDU226:AAX=RND(1280):
MOVEAAX,B%:VDU226:BBX=B%:IFAAX-16<A% AND
AAX-16>A%-32 THEN60ELSEGOTO16
   46 IFD%<B% ANDRND(5)=1THEN48
   47 GOTO16
   48 RS%=RND(140):MOVEC%,D%:GCOL4,3:
DRAWA%+RS%,B%:SOUND1,-15,255,1:SOUND2,
-15,250,1:GCOL4,0:DRAWC%,D%:IFRS%<65THEN
60
   49 GOTO16
   50 DEFPROCTERR
   51 VDU19,2,2,0,0,0:*FX15
   52 AAX=0:BBX=-10
   53 IFT%>995PROCNM
   54 VDU4:PROCCOL(2):CLS:COLOUR3:PRINTT
AB(0,1);"Score=";S%;"  ";
   55 IFLIV%>3PROCSL ELSEPRINTSTRING$(LI
V%-1,CHR$230+CHR$231+" ");
   56 PRINT" ";"Hi-score=";HH%(1);"  ";N
$(1):VDU5:MOVE0,0:GCOL0,2:FORM%=0TO1100S
TEP100:X=RND(10)*32-2:DRAWM%,X:NEXT:DRAW
1200,X
   57 DRAW1300,RND(10)*32-2:AL=0:IFA%>10
00THENA%=10 ELSEIFA%<10A%=1200
   58 ENDPROC
   59 IFB%<=0B%=10 ELSEIFB%>=1000 B%=990
   60 *FX15,0
   61 SOUND0,2,4,50
   62 VDU19,0,8,0,0,0,19,3,0,0,0,0:GCOL0
,1:FORN%=1TO50:MOVEA%+32,B%-16:DRAWRND(1
280),RND(1024):NEXT
   63 VDU4,19,0,7,0,0,0,19,3,0,0,0,0
   64 LIV%=LIV%-1:IFLIV%>0THEN110ELSEL%=
0
   65 COLOUR0:PROCCOL(8):CLS:COLOUR1:PRI
NT'''TAB(9);"Air Strike Hi-scores.":COLO
UR3:PRINT'':FORN%=1TO5:IFN%=L%COLOUR2ELS
ECOLOUR3
   66 PRINTN%;")";N$(N%);"....";HH%(N%)'
 :NEXT
   67 IFS%>=HH%(5)GOTO84
   68 COLOUR1:PRINT''TAB(9)"Press S to s
tart.":REPEATUNTILGET$="S":GOTO8
   69 DEFPROCEXP
   70 MOVEC%,D%:GCOL0,1:AL=1
   71 IFR=1PRINTC$ELSEIFR=2PRINTB$ELSEIF
R=3VDU235,236ELSEVDU237,238
   72 SOUND0,2,5,50:FORM2%=1TO3:VDU19,1,
M2%;0;0;0;:TIME=0:REPEATUNTILTIME>2:NEXT
:MOVEC%,D%:GCOL0,0:IFR=1PRINTC$ELSEIFR=2
PRINTB$ELSEIFR=3VDU235,236ELSEVDU237,238
   73 GCOL0,1:VDU19,1,1,0,0,0
   74 FORN%=3TO0STEP-1:GCOL0,N%:MOVEC%-5
0,D%:DRAWC%+50,D%:MOVED%-50,C%:DRAWD%+50
,C%:MOVEC%-50,D%-50:DRAWC%+50,D%+50:MOVE
 C%-50,D%+50:DRAWC%+50,D%-50:MOVEC%,D%+5
0:DRAWC%,D%-50:NEXT
   75 C%=0:D%=0:ENDPROC
   76 DEFPROCAFIRE
   77 MOVEC%,D%-16:GCOL4,3:DRAW0,D%-16:
SOUND1,-15,255,1:SOUND2,-15,250,1:GCOL4,
0:DRAWC%,D%-16:IFD%-16<B% ANDD%-16>B%-32
THEN78ELSEENDPROC
   78 GOTO60
   79 DEFPROCSC
   80 P%=S%
   81 IFR=1S%=S%+PT%*BON% ELSEIFR=2 S%=
S%+PT%*2*BON% ELSEIFR=3 S%=S%+40*BON%
ELSES%=S%+30*BON%
   82 T%=T%+S%-P%
   83 VDU4:PRINTTAB(6,1);S%:VDU5:ENDPROC
   84 *FX15,0
   85 PRINT''TAB(15);"Hi-score!!"
   86 PRINT''TAB(3);:INPUT"Please enter
your name ",AA$:IFLEN(AA$)>4THENAA$=LEFT
$(AA$,4)ELSEIFLENAA$<4REPEAT:AA$=AA$+" "
:UNTILLENAA$=4
   87 AA$=AA$+" "+STR$(LEV%)
   88 L%=0:REPEAT:L%=L%+1:UNTILHH%(L%)<=
S%ORL%=5
   89 IFL%=6GOTO93
   90 H%=6:REPEAT:H%=H%-1:HH%(H%)=HH%(H%
-1):N$(H%)=N$(H%-1):UNTILH%=L%
   91 N$(L%)=AA$:HH%(L%)=S%:S%=0:GOTO65
   92 IFMID$(AA$,6,1)<MID$(N$(5),6,1)L%=
4:GOTO90
   93 S%=0:GOTO65
   94 *FX15,0
   95 SOUND0,2,4,50:FORN%=1TO50:MOVEC%+
16,B%-16:DRAWRND(1280),RND(1024):NEXT:
GOTO63
   96 MS%=40:CR%=25:FR%=3:PT%=20:RETURN
   97 MS%=15:CR%=15:FR%=8:PT%=10:RETURN
   98 MS%=10:CR%=10:FR%=10:PT%=5:RETURN
   99 TIME=0:REPEATUNTILTIME=100:A%=50:
B%=500:PRINTTAB(6+LIV%*2,1);"  ":VDU5:
GOTO11
  100 DEFPROCCOL(Z%):VDU20,19,2,Z%,0,0,0
:ENDPROC
  101 DEFPROCNM:PROCCOL(9):COLOUR2:VDU4:
T%=T%-1000:PRINTTAB(10,12)"EXTRA SHIP BO
NUS":LIV%=LIV%+1:FORN%=1TO3:SOUND3,-15,2
50,10:TIME=0:REPEATUNTILTIME=100:NEXT:EN
DPROC
  102 DEFPROCSL:PRINTA$;"+";LIV%-2;:ENDP
ROC
  103 DEFPROCINST:PROCCOL(6):COLOUR130:C
OLOUR0:CLS
  104 PRINT'TAB(15);"AIR STRIKE":PRINT'"
You have three ships.Z moves you down,"'
'"A moves you up,press SHIFT to accelera
te":PRINT"and RETURN to fire."''"You can
 move through the mountains"''"without e
xploding,but do not go too far"
  105 PRINT'"up or down.Level 3 is the e
asiest,"''"level 1 the hardest.There are
 more"''"points to be gained in level 1
than in"''"the other levels."''"Press 'S
' to continue."'''"Press <ESCAPE> to ret
urn to this page."
  106 REPEATUNTILGET$="S"
  107 CLS:PRINT''A$;"  Your ship."''B$;"
  Alien ship.Moves about and fires"''"at
 you."''C$;"  Death satellite.Moves in c
lose and"''"explodes."''CHR$235;CHR$236"
  Radar base.Fires accurate missiles"''"
at overhead ships."''CHR$237;CHR$238;
  108 PRINT;"  AA gun.Fires flak at over
head ships.":PRINT"Press S to start.";:R
EPEATUNTILGET$="S"
  109 ENDPROC
  110 REPEATUNTILADVAL(-5)=15:A%=50:IFB%
<100 B%=200
  111 GOTO11
  112 DEFPROCTUNE:PRINTTAB(15,15);" READ
Y !!"
  113 LOCALN%,A%:RESTORE115:FORN%=1TO13:
READA%:SOUND1,-15,A%,3:SOUND2,-15,A%-48,
3:NEXT:SOUND1,-15,101,7:SOUND2,-15,53,7
  114 PRINT''TAB(15);"Here we go....":TI
ME=0:REPEATUNTILTIME>100:ENDPROC
  115 DATA101,117,129,117,109,121,137,12
1,101,117,129,117,101
```

Nice line in deduction, Mr Holmes



Elementary Basic – Teach yourself Basic by solving the mysteries of Sherlock Holmes. *Henry Ledgard and Andrew Singer.*

AS a Sherlock Holmes fan of long standing I have been amazed at the number of trunks that have turned up recently containing previously unpublished memoirs of the great detective.

Dr Watson must have had a full time job in his declining years just hiding the things! And how he arranged for them to be discovered after the copyright expired baffles me.

Most of the trunks would have been better off undiscovered, but here, to my joy, is a book that pleases me both as a Holmes afficionado and as a micro nut.

Elementary Basic is really two books in one. At one level it is a collection of some of Holmes' less remarkable cases, the only points of interest being supplied by his ingenious use of Mr Babbage's analytical engine in the science of detection.

Additional to these accounts are short essays on how Holmes communicated with the engine by means of a language called – you've guessed it – Basic.

Both parts of the book work remarkably well. The efforts of Holmes to explain algorithms and Basic to the brilliantly obtuse Watson are supplemented by short, lucid essays on the aspects of Basic Holmes has raised.

To me these essays are the best part of a very good book.

They are concise, clear and thought-provoking, giving an insight into the structure and purpose of Basic without being specific to any one machine.

The example algorithms and programs are at times almost beautifully logical.

All in all a book that was a joy to read. Not just another "Basic, how to" book, but a lively and entertaining introduction to Basic in particular and good programming in general.

So good, in fact, that I will forgive it one basic elementary error. Holmes never actually said "Elementary, my dear Watson".

Assembling from the ground up

Assembly Language Programming for the BBC Microcomputer *by Ian Birnbaum, 305 pages, £8.95. Macmillan Press, 1982.*

BBC Microcomputer Basic includes many powerful features, not least of which is a fully integrated assembly language system for use in developing 6502 machine code.

For those familiar with other more conventional assemblers, note that "fully integrated" means that the Basic interpreter is used during assembly to evaluate instructions such as LDA 100*SIN(Angle*PI/180).

Unfortunately the User Guide from Acorn provides little guidance on the use of assembler, being aimed at the user with prior experience of 6502 machine code, and a book to fill this gap was much needed.

Ian Birnbaum says his book is written for those familiar with Basic but new to assembler, and is a suitable basis for use in a structured course on the subject.

Chapter 1 outlines how a computer interprets machine code commands, and introduces the concept of an assembly language using mnenomics (such as keywords). It then discusses the role of assembler v high level compiled or interpreted languages.

Chapters 2 to 9 are in the form of a series of tasks to be addressed in assembler, with each statement type explained as the need arises.

Useful routines are developed, and there are exercises for the reader at the end of each chapter, with a full set of solutions at the back.

Chapter 10 comprises the listings and documentation for six utility programs, including a very useful machine code monitor program to assist debugging of machine code programs, and a very fast program which searches memory and reports where a given Ascii, machine code or numeric sequence is in memory.

Appendices are used to provide a quick reference to the 6502 instruction set, a discussion of indexed indirect addressing (for which no application arose in the main text), linking BBC computer programs, user port applications, the zero page and operating system differences.

All supported features of the BBC assembler are covered, except the new

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From Page 55

facilities (such as Macros) which are present in the Basic II chip, revealed too late for this book.

The programs developed in the book are also available on two cassettes priced at £9 each or £16 the pair, a nice marketing touch being that each cassette contains two further interesting routines which are not in the book, so why bother typing?

I believe that Ian Birnbaum's book will prove to be of great value to those who wish to teach or learn assembler for use on the BBC Micro "from the ground up".

The book is organised in application-oriented format and therefore more likely to hold the attention of a student.

Unfortunately there is no detailed subject index, a great drawback to the experienced 6502 programmer in that it is difficult to glean the niceties specific to the BBC Micro except by reading the whole book.

In summary, if you have a BBC Micro and are a complete novice wishing to learn assembler, then this is the book for you.

When you have worked through it you will join those more experienced programmers who hope for the publication of a good BBC Micro reference book – indexed!

Two further books on assembler for the BBC Micro are to be published later this year, one of which I understand will be from the BBC itself (or herself?). Watch this space for news of these.

P.S. If you are writing a book called "The BBC Micro REALLY Revealed", please publish it soon!

David Reader

Make sure your collection is complete!

Articles in the March issue included:

BBC MICRO USER
Play DEATH WATCH!
Iron out those cassette bugs
Build your own games paddle
What's good – and bad – in BBC software
Explore with the experts in programmers' workshop
FREE!

- ☐ Part 1 of our series on computing for beginners.
- ☐ How to build your own games paddle.
- ☐ Review of the Alphabeta word processor.
- ☐ Part 1 of our easy to-understand guide to text colours and graphics.
- ☐ Part 1 of our introduction to the BBC operating system.
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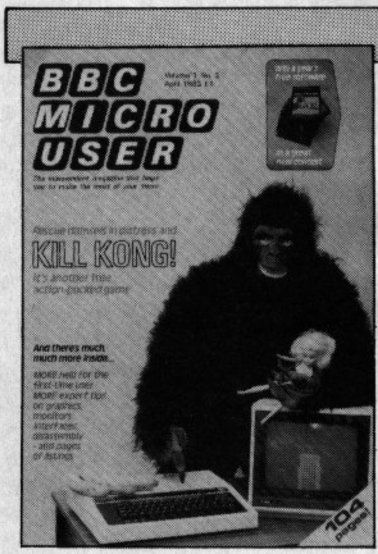
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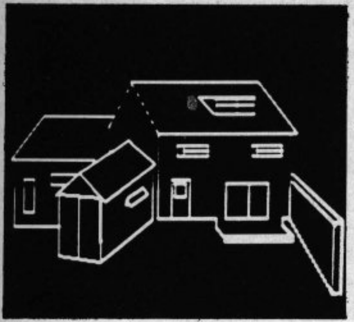

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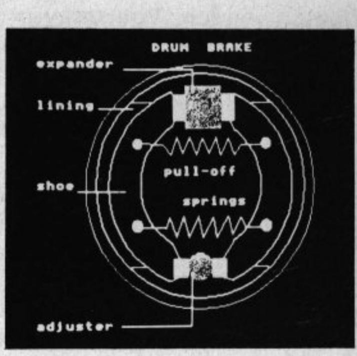

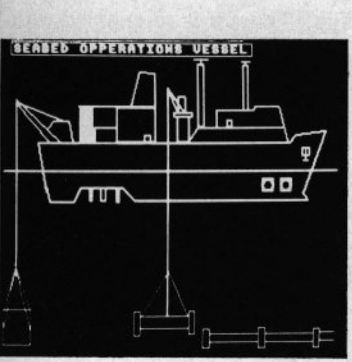

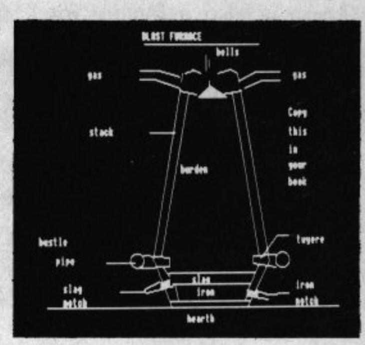

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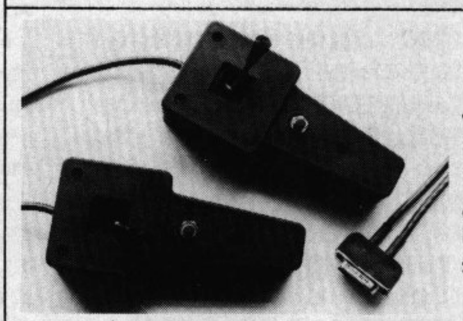

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ANAGRAMS is a program that demonstrates how a simple idea can be developed into a sophisticated program which can then be used in a variety of educational contexts or as a game in its own right.

The idea is to solve a series of 25 anagrams. The program sets a time limit for each attempt, which you may exceed if you wish.

However, the computer uses the time you take and the difficulty of the word, determined by its length, to calculate your skill level.

As your skill increases throughout the game, so the anagrams presented to you become longer.

At the end, the program displays your skill level as well as your total and average score.

There is also a facility for logging the name of the highest scorer, as in all good arcade games.

As it stands, the game describes objects that would be found in the kitchen. You may wish to change, or add to, the data, particularly the longer words so as to give more available anagrams.

Also, it would not be too hard to add a procedure to input the data from cassette instead of having the data embedded in DATA statements.

It would then be simple to prepare a whole series of tapes on different subjects.

The following details should give sufficient understanding of the program to allow conversion work to be undertaken:

PROCSTART (called at line 60) turns off the cursor with VDU23;8202;0;0;0;.

If you have ROM 1.0 or above, this should be changed to VDU 23,1,0;0;0;0; – the cursor is re-enabled with VDU

```
   10 REM Anagrams '83
   20 REM
   30 REM C.Turnbull.
   40 REM
   50 MODE7
   60 PROCSTART
   70  REPEAT
   80 PROCSetvars
   90 PROCInstructions
  100 CLS
  110 FORTry%=1 TO 25
  120 REPEAT
  130 F%=RND(50)
  140 UNTIL LEN(Data$(F%))=Skill% AND Da
ta$(F%)<>Last$
  150 Right$=Data$(F%)
  160  REPEAT:Word$=Right$:PROCJUMBLE: U
NTIL Right$<>Word$
  170 PRINT'"THE JUMBLED WORD IS:";
  180  FORT%=0 TO 1:PRINTTAB(7,T%+2);CHR
$(130);CHR$(141);WORD$:NEXT
  190 Trytime%=INT(1.8*LEN(Word$))
  200 PRINT'"YOU HAVE ";Trytime%;" SECON
DS."
  210 TIME=0
  220 PRINT
  230 INPUT Answer$
  240 Timetaken%=INT(TIME/100)
  250  PRINT''"YOU TOOK ";Timetaken%;" S
ECONDS,";
  260 PROCMarks
  270 PRINT'"YOUR CURRENT SCORE IS......
....";CHR$(130);Score%
  280 PRINT'"YOUR CURRENT SKILL LEVEL IS
....";CHR$(130);Skill%
  290 PRINT''CHR$(131);CHR$(8);CHR$(157)
;CHR$(134);
  300 PRINT"            PRESS ANY KEY.";CHR
$(8);:PROCGet:CLS
  310 Last$=Right$
  320 NEXTTry%
  330 CLS
  340  PROCAverages
  350  UNTIL Finish
  360  *FX12,0
  370  END
  380 REM################################
  390 DEFPROCJUMBLE
  400 Length%=LEN(Word$)
  410 FORT%=1 TO Length%:Word$(T%)="":Ch
eck%(T%)=0
  420 NEXTT%
  430 FORT%=1 TO Length%
  440  REPEAT
  450 D%=RND(Length%)
  460  UNTIL Check%(D%)<>1
  470 Check%(D%)=1:Word$(D%)=MID$(Word$,
T%,1)
  480 NEXTT%
  490 Word$="":WORD$=""
  500 FORT%=1 TO Length%
  510 Word$=Word$+Word$(T%)
  520  WORD$=WORD$+Word$(T%)+" "
  530 NEXTT%
  540 ENDPROC
  550 REM################################
  560 DEFPROCInitdims
  570 DIMCheck%(15),Word$(15),Data$(50)
  580 FORT%=1 TO 50:READData$(T%):NEXTT%
  590 RESTORE
  600 ENDPROC
  610 CLS
  620 REM################################
  630 DEFPROCInstructions
  640 CLS
  650 FORT%=0 TO 1:PRINTTAB(0,T%);CHR$(1
32);CHR$(157);TAB(14);CHR$(131);CHR$(141
)"Anagrams":NEXTT%
  660 PRINTTAB(0,4);CHR$(130);"Instructi
ons."
  670 PRINTTAB(2,6);"The computer will d
isplay a word,this   word is an anagram
of something found   in a kitchen,rangin
g from cutlery and   appliances to food
and drinks."
  680  PRINT'TAB(2);"It will also displa
y a time,this time   is your limit.If yo
u take longer,then   you will lose point
s,more points lost   for the more time u
sed,but if you put   in your word before
 the time runs out  ";
  690 PRINT" you will gain points,of cou
rse,if you   get the word wrong you lose
 even more."
  700 PRINT';CHR$(131);CHR$(157);TAB(6);
CHR$(136);CHR$(130);"PRESS ANY KEY.":PRO
CGet
  710 CLS
  720 FORT=0 TO 1:PRINTTAB(0,T);CHR$(132
);CHR$(157);TAB(8);CHR$(131);CHR$(141)"M
ore instructions.":NEXT
  730 PRINTTAB(2,4)"To put in your word,
```

23,1,1;0;0;0;.

The auto-repeat is disabled with *FX11,0 – it is re-enabled at the end of the program with *FX12,0.

This procedure also sets the Boolean variable FINISH which tests for the end of the program and calls PROCInitdims which initialises the arrays (line 570) and reads the data into Data$( ).

It also sets the high score, High%, to zero and the name of the scorer, High$, to nobody.

Lines 120-140 pick a number F% in the range 1 to 50 and use it to index Data$( ), i.e. Data$(F%) picks out a word for the next anagram.

Last$ holds the word last chosen and Skill% is the skill level involved, which is the length of the word.

Thus, line 140 checks that the word chosen is of the right length and has not just been picked.

Line 150 stores the word chosen in Right$. Line 160 is a loop that stores Right$ in Word$.

The latter is then "anagrammed" in PROCJumble and checked to ensure that Right$ <>Word$, i.e. that it has not emerged still in the correct order – "butter" is not a very good anagram for "butter"!

PROCJumble works by using array WORD$( ) to store randomly picked letters from Word$.

Each time a letter is picked, the element of Check%( ) corresponding to the position of that letter in Word$ is set to 1. This "flag" is used to ensure that an individual letter is not picked twice (line 460).

Finally, the elements of array Word$( ) are concatenated and stored in Word$ – so that this now contains an anagram of its original self (which is still stored in Right$).

Also WORD$ is built up. This is identical to the newly jumbled Word$ except that its letters are separated by spaces.

PROCMarks alters the skill level (Skill%) as necessary depending on the values of Trytime%, which is the time allowed for a word, and Timetaken% which is the time actually taken for an answer.

PROCAverages gives the average score, calling either PROCNewhigh or PROCSave, depending on whether a new high score has been achieved. Given all these details, it should be fairly easy to determine the workings of the program, particularly as descriptive variable names have been used throughout, single letter variables being reserved for loop parameters, etc.

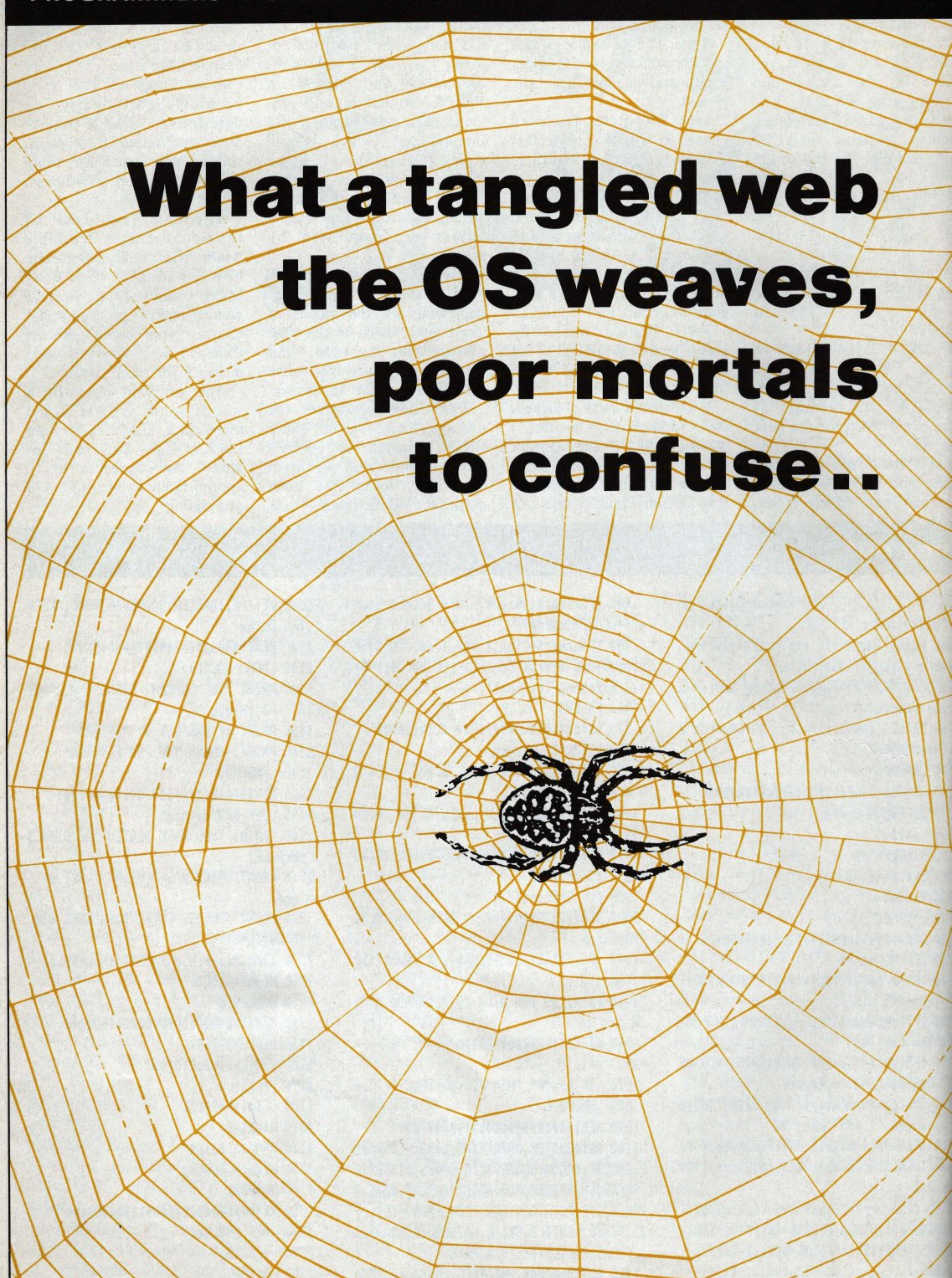
Those of us used to restricted length variable names will readily appreciate how readable the BBC Micro's approach to variable names makes programs. Of course, you could shorten these if you wish to save memory for more data.

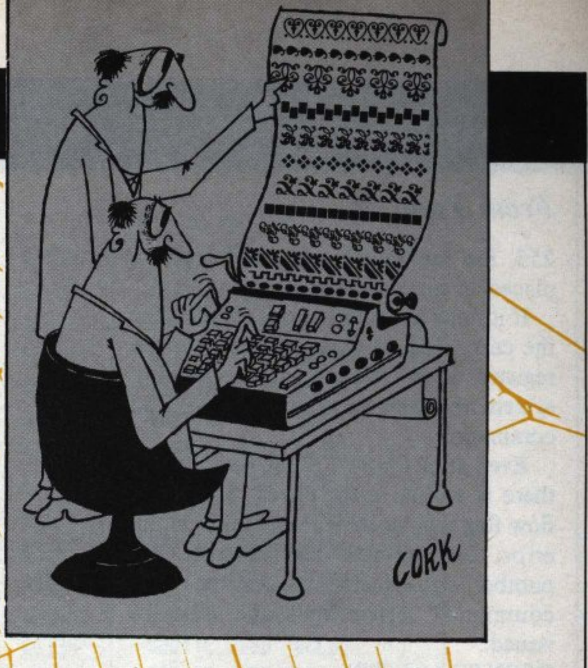
This program was written with 50 words as data. To add more data, simply add extra DATA statements and increase the references to 50 appropriately in lines 130, 570 and 580.

hings out

```
type it in,using    the keyboard,then pr
ess";CHR$(134);"RETURN"
  740 PRINT'TAB(2)"If you press a wrong
key,press";CHR$(133);"DELETE"
  750 PRINTTAB(2)"The offending letter w
ill be removed."
  760 PRINT''TAB(2);"Press 'RETURN' to s
tart";:PROCGet
  770 ENDPROC
  780 REM###############################
  790 DEFPROCSetvars
  800 Last$=""
  810 Right$=" "
  820 Skill%=4
  830 Score%=0
  840 ENDPROC
  850 REM###############################
  860 DEFPROCMarks
  870 IFTimetaken%<Trytime%THENPRINT"WIT
HIN THE TIME LIMIT"
  880 IFTimetaken%>Trytime%THENPRINT"OUT
SIDE THE LIMIT"
  890 IFRight$=Answer$ THEN PRINT"YOU GO
T IT RIGHT,IT WAS ";Right$
  900 IFRight$<>Answer$ THEN PRINT"YOU G
OT IT WRONG,IT WAS ";Right$
  910 IFAnswer$=Right$ AND Timetaken%<Tr
ytime%THEN Score%=Score%+(LEN(Word$))+2*
Trytime%
  920  IFAnswer$=Right$ AND Timetaken%<(
2*LEN(Word$)) THEN Skill%=Skill%+1:IFSki
ll%>=9 THENSkill%=9 ELSE Skill%=Skill%-(
RND(2)-1)
  930 IFSkill%<3 THEN Skill%=3
  940 IFAnswer$<>Right$ THEN Score%=Scor
e%-(20-LEN(Word$))
  950 IFAnswer$=Right$ AND Timetaken%>Tr
ytime%THEN Score%=Score%+(LEN(Word$))-5*
((Timetaken%-Trytime%))
  960 ENDPROC
  970 ##################################
  980 DEFPROCAverages
  990 CLS:PRINT"YOUR TOTAL SCORE AFTER 2
5 WORDS ]";Score%
 1000 PRINT"YOUR SKILL LEVEL AFTER 25 WO
RDS ]";Skill%
 1010 PRINT"YOUR AVERAGE SCORE FOR 25 WO
RDS ]";Score%/25
 1020 AVSC%=Score%/25
 1030 IFAVSC%>High%THEN PROCNewhigh ELSE
 PROCSame
 1040  PRINTTAB(0,22);CHR$(132);CHR$(157
);CHR$(131);
 1050 PRINT"DO YOU WISH TO PLAY AGAIN?(Y
/N)"
 1060 REPEAT:PROCGet:UNTIL A$="Y" OR A$=
"N"
 1070  IF A$="N" THEN Finish=TRUE
 1080  ENDPROC
 1090 REM##############################
 1100 DATABUTTER,MARGARINE,LARD,VEGETABL
E,CHEESE,BACON,SUGAR,NUTS,CAKES,BISCUITS
,BREAD,CHIPS,CEREALS,WHEAT,BARLEY,OATS,R
ICE,MAIZE,POTATOES,EGG,FISH,EGGS,MILK,PE
AS,BEANS,LENTILS,BREAD,HAZELNUTS,ORANGES
,LEMONS,HAM,LETTUCE,CARROTS
 1110 DATABANANAS,POTATOES,CABBAGES,BREA
D,BACON,TOMATOES,CHEESE,BISCUITS,FORKS,S
POONS,KETTLE,TOASTER,SAUCEPAN,PEAS,COFFE
E,TEA,SUGAR
 1120 REM#############################
 1130  DEF PROCSame
 1140 PRINT'"THE CURRENT HIGHEST AVERAGE
 IS    ]";High%
 1150 PRINT"IT WAS SET BY ";High$
 1160 PRINT'"THANK YOU FOR PLAYING"
 1170  ENDPROC
 1180 REM##############################
 1190  DEF PROCNewhigh
 1200  PRINT'"YOU HAVE BEATEN THE HIGHES
T AVERAGE"
 1210 PRINT"WHICH WAS ";High%;" SET BY "
;High$
 1220 PRINT'"PLEASE ENTER YOUR NAME (ONL
Y 15 LETTERS)"
 1230 INPUTHigh$:High$=LEFT$(High$,15)
 1240 High%=AVSC%
 1250  ENDPROC
 1260 REM#############################
 1270 DEFPROCSTART
 1280 VDU23;8202;0;0;0;
 1290  *FX11,0
 1300  Finish=FALSE
 1310 High%=0
 1320 PROCInitdims
 1330 High$="Nobody"
 1340 ENDPROC
 1350 REM#############################
 1360  DEF PROCGet
 1370  *FX 15,1
 1380  A$=GET$
 1390  ENDPROC
```

What a tangled web the OS weaves, poor mortals to confuse..





By JIM NOTMAN

ONE difficulty with looking at the operating system is that at the moment there are still a number of different versions around, from the infamous 0.1, with its well known Cassette Filing System problems, to the (for the present) definitive 1.20, capable of supporting paged ROMs, the disc system, Econet, Teletext and numerous other goodies.

I'll be looking mainly at the 1.20 version, which is now becoming widely available according to Acorn and should be around for a while. Many of the routines in the 1.0 version are very similar in what they do and in memory locations.

The main problem with having a closer look at the operating system in the BBC Micro is knowing where to start, as it is long – not much less that 16k – and because of the way the operating system is structured, with routines being called within routines and some of those being vectored. The system weaves a very tangled web.

The command line interpreter (&DF89)

This is responsible for recognising instructions and jumping to the appropriate action address. It has some features which are noted below.

Like the Basic keyword table (&806D-&8359) the operating system has a command table located from about &DF00. The command table program (Program I) will print out the commands, the action addresses and an extra byte which is loaded into the accumulator before jumping to the action address.

```
   10REM Jim Notman (c) 1983
   20ADDRESS=&DF10
   30REM 1.0=&DF04 : 0.1=&DFEB
   40FINISH=&DF84
   50REM 1.0=&DF79 : 0.1=&E060
   60PRINT"Command  action   extra"
   70PRINT"         address  byte"
   80REPEAT
   90REPEAT
  100PRINTCHR$(?ADDRESS);
  110ADDRESS=ADDRESS+1
  120UNTIL?ADDRESS>&7F
  130PRINTTAB(10);~(?ADDRESS*256)
+ADDRESS?1;
  140PRINTTAB(18);~ADDRESS?2
  150ADDRESS=ADDRESS+3
  160UNTILADDRESS>FINISH
```

Program I

```
   10 REM OSBYTE action addresses
   20 REM for OS 1.20
   25 REM Jim Notman (c) 1983
   30 VDU14
   40 OSBYTE=0:offset=0
   50 REPEAT
   60 PRINT"OBYTE ";OSBYTE"
&";~!(&E5B3+(OSBYTE-offset)*2) AND
&FFFF
   70 IF OSBYTE=21 THEN OSBYTE=116
:offset=&5F
   80 OSBYTE=OSBYTE+1
   90 UNTIL OSBYTE>160
  100 PRINT"OSBYTE calls>166 &E99C"

For OS 1.00 the following changes need
to be made :-
line 60 the address needs to be &E56E
line 70 IF OSBYTE=22 THEN OSBYTE=115:
offset=&5D
line 90 UNTIL OSBYTE>161
line 100 PRINT"OSBYTE calls>166 &E9AF
```

Program II

It is interesting to note that:

- The commands no longer appear to be preceded by an *, as this is not passed to the operating system, or as can happen (if you type in two or more *'s together), they are stripped off by the command line interpreter.
- The command is immediately followed by its action address, unlike Basic where there were separate tables for the high byte and low bytes. Like Basic there is an "extra" byte. This is placed in the accumulator before being directed to the action address.
- The action address is in the form high byte then low byte. This is opposite to the way that you would expect for a 6502 system. The reason for it here is that since the high byte will be greater than &80 it can be used to separate the command from the address. The command line interpreter manipulates the address so that it is in the form required by the 6502.
- The first command is '.' so you can see that it is not just an abbreviation for *CAT, but a command in its own right.
- There appear to be two new commands not documented in the User Guide – *CODE and *LINE.
- Some of the commands share common action addresses, but have different values placed in the accumulator. This is especially true for the action address &E348, where MOTOR, OPT, TAPE, ROM, TAPE and CODE are all directed.
- The action address of FX closely precedes them. This is because all these commands are converted to OSBYTE calls by this routine (Table II).
- The commands you type in ***do not have to be in upper case!*** Before checking whether a word is present in its command table it does a Boolean AND with &DF with each letter. This effectively changes a lower case letter into an upper case letter.

This sort of trick is very useful to know, especially for inputs in a Basic program where inexperienced users may not realise the difference and programmers have forgotten to take it into account.

OSBYTE setup routine (&E342)

Before a call can be made to OSBYTE the accumulator, X register and Y register must be 'primed' with values. FX has the earlier entry because it must gather up three bytes of information, whereas the other commands already have a correct value for the accumulator and only need to have their X and Y registers loaded with appropriate values. A disassembly of the routine is given in Program III.

The main purpose of the subroutines that leave this OSBYTE setup routine is not only to get values for the registers but also to check that they do not contain any non-numeric characters or any numbers greater than

→

From Page 61

255, the maximum value that can be placed in an 8 bit register.

If it finds anything wrong it will clear the carry flag so that, on return to the register load routine, the operating system will branch to an error – "Bad command".

Even after OSBYTE has been called, there is still an error check. The overflow flag will be set if there has been an error, for example an incorrect FX number was selected, so that the "Bad command" error message can be issued.

OSBYTE (&E772)

One of the most powerful features of the BBC Micro is that many of the functions that the machine can perform are not controlled by PEEKing and POKEing memory locations, but by specific calls to the operating system. This gets around the constant problem which manufacturers have of updating hardware and operating systems without making you rewrite all of your software.

OSBYTE allows a large number of functions to be made available to the programmer without the need for a very long command table. However the machine must have some way of deciding where all the calls should go.

```
E342  20  4E  E0 JSR &E04E        \ FX entry point.
E345  90  C9     BCC Bad command
E347  8A         TXA
E348  48         PHA              \ Other commands entry point.
E349  A9   0     LDA #&0
E34B  85  E5     STA &E5
E34D  85  E4     STA &E4
E34F  20  43  E0 JSR &E043
E352  F0  18     BEQ &E36C
E354  20  4E  E0 JSR &E04E
E357  90  B7     BCC Bad command
E359  86  E5     STX &E5
E35B  20  45  E0 JSR &E045
E35E  F0   C     BEQ &E36C
E360  20  4E  E0 JSR &E04E
E363  90  AB     BCC Bad command
E365  86  E4     STX &E4
E367  20  3A  E0 JSR &E03A
E36A  D0  A4     BNE Bad command
E36C  A4  E4     LDY &E4
E36E  A6  E5     LDX &E5
E370  68         PLA
E371  20  F4  FF JSR OSBYTE
E374  70  9A     BVS Bad command
E376  60         RTS
```

Program III: OSBYTE setup routine

When OSBYTE is called (as can be seen from Program IV) it uses the value it has in the accumulator to calculate the action address from a table starting at &E5B3.

The routine checks for legal values of the accumulator. With all calls numbered 21 (&15) or under, this value is

```
E772  48         PHA
E773   8         PHP
E774  78         SEI
E775  85  EF     STA &EF
E777  86  F0     STX &F0
E779  84  F1     STY &F1
E77B  A2   7     LDX #&7
E77D  C9  75     CMP #&75
E77F  90  41     BCC &E7C2 \ values < 117 (&75)
E781  C9  A1     CMP #&A1
E783  90   9     BCC &E78E \ values < 161 (&A1)
E785  C9  A6     CMP #&A6
E787  90  3F     BCC &E7C8 \ values < 166 (&A6) - Discard
E789  18         CLC
E78A  A9  A1     LDA #&A1  \ all values 161 or more
E78C  69   0     ADC #&0
E78E  38         SEC
E78F  E9  5F     SBC #&5F  \ subtract from values > 117
                             (&75)
E791   A         ASL A     \ *2 for offset
E792  38         SEC
E793  84  F1     STY &F1
E795  A8         TAY
E796  2C  5E   2 BIT &25E
E799  10   7     BPL &E7A2
E79B  8A         TXA
E79C  B8         CLV
E79D  20  7E  E5 JSR &E57E     \ no action unless (&224)
                                 changed
E7A0  70  1A     BVS &E7BC
E7A2  B9  B4  E5 LDA &E5B4,Y \ high byte
E7A5  85  FB     STA &FB
E7A7  B9  B3  E5 LDA &E5B3,Y \ low byte
E7AA  85  FA     STA &FA
E7AC  A5  EF     LDA &EF       \ acc. on routine entry
E7AE  A4  F1     LDY &F1       \ store for Y register
E7B0  B0   4     BCS &E7B6
E7B2  A0   0     LDY #&0
E7B4  B1  F0     LDA (&F0),Y
E7B6  38         SEC
E7B7  A6  F0     LDX &F0       \ store for X
E7B9  20  58  F0 JSR &F058     \ see below
E7BC  6A         ROR A
E7BD  28         PLP
E7BE  2A         ROL A
E7BF  68         PLA
E7C0  B8         CLV
E7C1  60         RTS
E7C2  A0  0      LDY #&0
E7C4  C9  16     CMP #&16
E7C6  90  C9     BCC &E791     \ values < 22 (&16) rejoin
                                 OSBYTE
F058  6C  FA  00 JMP (&FA)   \ action address
```

Program IV: Disassembled OSBYTE routine

```
OSBYTE  0   &E821  | OSBYTE  17  &DE8C | OSBYTE  129 &E713 | OSBYTE  146 &FFAA
OSBYTE  1   &E988  | OSBYTE  18  &E9C8 | OSBYTE  130 &E729 | OSBYTE  147 &EAF4
OSBYTE  2   &E6D3  | OSBYTE  19  &E9B6 | OSBYTE  131 &F085 | OSBYTE  148 &FFAE
OSBYTE  3   &E997  | OSBYTE  20  &CD07 | OSBYTE  132 &D923 | OSBYTE  149 &EAF9
OSBYTE  4   &E997  | OSBYTE  21  &F0B4 | OSBYTE  133 &D926 | OSBYTE  150 &FFB2
OSBYTE  5   &E976  | OSBYTE  117 &E86C | OSBYTE  134 &D647 | OSBYTE  151 &EAFE
OSBYTE  6   &E988  | OSBYTE  118 &E9D9 | OSBYTE  135 &D7C2 | OSBYTE  152 &E45B
OSBYTE  7   &E68B  | OSBYTE  119 &E275 | OSBYTE  136 &E657 | OSBYTE  153 &E4F3
OSBYTE  8   &E689  | OSBYTE  120 &F045 | OSBYTE  137 &E67F | OSBYTE  154 &E9FF
OSBYTE  9   &E6B0  | OSBYTE  121 &F0CF | OSBYTE  138 &E4AF | OSBYTE  155 &EA10
OSBYTE  10  &E6B2  | OSBYTE  122 &F0CD | OSBYTE  139 &E034 | OSBYTE  156 &E17C
OSBYTE  11  &E995  | OSBYTE  123 &E197 | OSBYTE  140 &F135 | OSBYTE  157 &FFA7
OSBYTE  12  &E98C  | OSBYTE  124 &E673 | OSBYTE  141 &F135 | OSBYTE  158 &EE6D
OSBYTE  13  &E6F9  | OSBYTE  125 &E674 | OSBYTE  142 &DBE7 | OSBYTE  159 &EE7F
OSBYTE  14  &E6FA  | OSBYTE  126 &E65C | OSBYTE  143 &F168 | OSBYTE  160 &E9C0
OSBYTE  15  &F0A8  | OSBYTE  127 &E035 | OSBYTE  144 &EAE3 | OSBYTE calls >166
OSBYTE  16  &E706  | OSBYTE  128 &E74F | OSBYTE  145 &E460 | &E99C
```

Table I: OSBYTE action addresses

```
Comand  action   extra | CODE   E348  88 | OPT    E348  8B
        address  byte  | EXEC   F68D  0  | RUN    E031  4
                       | HELP   F0B9  FF | ROM    E348  8D
  .     E031     5     | KEY    E327  FF | SAVE   E23E  0
 FX     E342     FF    | LOAD   E23C  0  | SPOOL  E281  0
BASIC   E018     0     | LINE   E659  1  | TAPE   E348  8C
 CAT    E031     5     | MOTOR  E348  89 | TV     E348  90
```

Table II: Command action addresses

used directly to compute the offset. Values between 22 (&16) and 116 (&74) inclusive are discarded, and values between 117 (&75) and 160 (&A0) have 95 (&5F) subtracted from this value before calculating the offset. Values between 161 (&A1) and 165 (&A5) inclusive are again discarded. All values 166 (&A6) and over are treated the same, having the same action address.

The offset is calculated by doing an arithmetic shift left (&E791) on the value remaining in the accumulator and using this to access the necessary bytes from the action address table.

The OSBYTE action addresses program will produce a list of the action addresses for OSBYTE OS 1.2.

For example, if we have a look at the OSBYTE call of 0 we can see it has the action address of &E821.

E821 D0 FB BNE &E81E

After that instruction (it doesn't branch) it "falls through" onto a BRK instruction which the BBC Micro handles by going into an error routine. The number after the BRK becomes the error code, with the bytes following being the error message, the message printed being "OS 1.20".

In the operating system 0.1 the error number was 0. Now with OS 1.00 and OS 1.20 the error number is 245 (&F7). So if you have written a program which requires the facilities of the newer systems all you need is to *FX0 and check the error number.

More crib cards to stick on your BBC Micro

BBC MICRO USER

Programmer's guide 4

Two Colour Modes: 0,4

Logical colour number		Colour
Foreground	Background	
0	128	Black
1	129	white

Four Colour Modes: 1,5

Logical colour number		Colour
Foreground	Background	
0	128	Black
1	129	Red
2	130	Yellow
3	131	White

BBC MICRO USER

Programmer's guide 5

Sixteen Colours: Mode 2

Logical No.		Colour	Colour*	Logical No.	
Fore ground	Back ground			Fore ground	Back ground
0	128	Black	White*	8	136
1	129	Red	Cyan*	9	137
2	130	Green	Magenta*	10	138
3	131	Yellow	Blue*	11	139
4	132	Blue	Yellow*	12	140
5	133	Magenta	Green*	13	141
6	134	Cyan	Red*	14	142
7	135	White	Black*	15	143

* = Flashing

N.B. *The foreground logical colour numbers on entry to Mode 2 are also the* ***actual*** *colour numbers of the BBC Micro's palette.*

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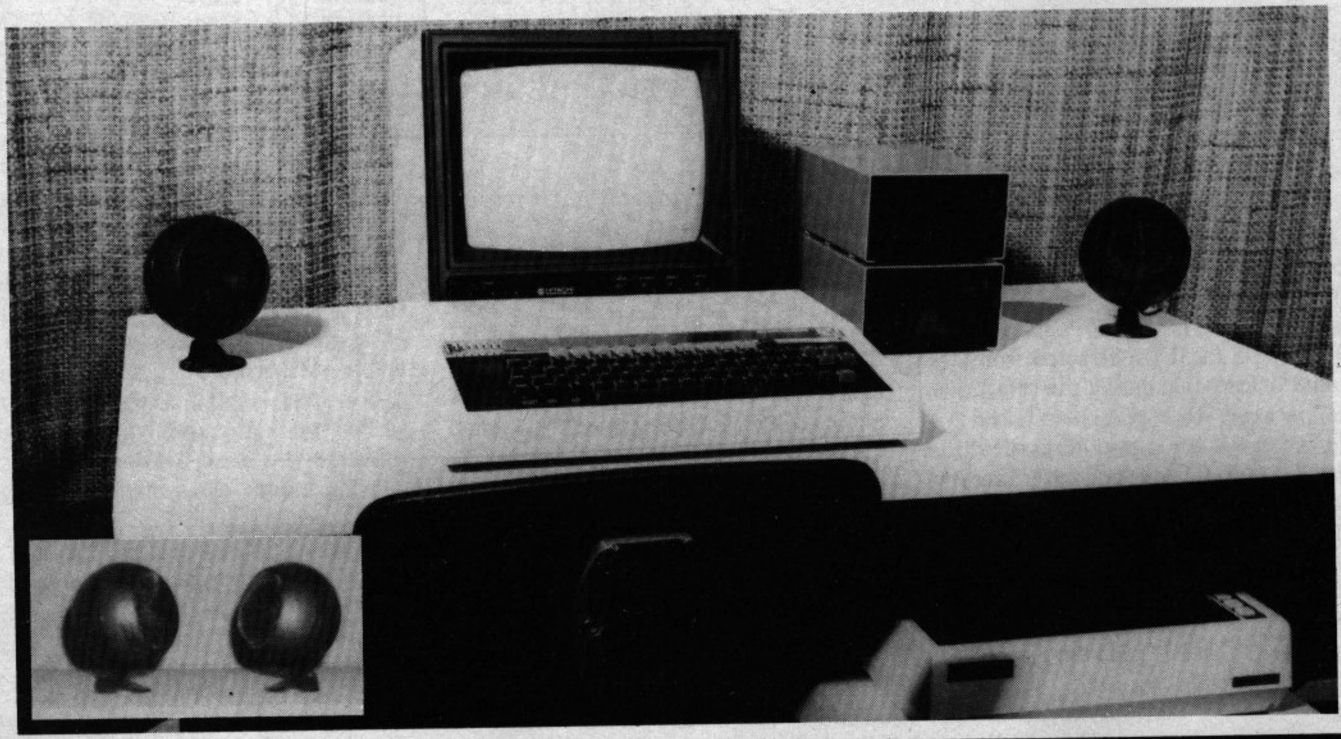

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More of a revue than a review..

SPLURGE

– the thinking man's Pascal

STRUCTURE is all important in computer programming, so much so that a language should be selected entirely on the basis of its structured properties. The majority of computer experts consider that it is more important that a language should be well structured than that it should be useful.

The new language about to be released on ROM is the most highly structured language so far available. This language, Splurge II, supports all the structures offered by Pascal and Algol, and in addition several novel structures which make Splurge particularly suitable for artificial intelligence, simulation and NP-complete problems.

Splurge offers all the usual structures, FOR, WHILE, REPEAT and IF, by enclosing the statements in the structure in the usual begin .. end compound statement, but in Splurge II the begin is replaced by the word DO and the end by the word DONT. An ELSE implies DONT ELSE DO, thus giving rise to statements such as:

```
IF A=B THEN DO B=C; A=D
ELSE DONT
```

The existence of DO and DONT allow reverse structures to be set up, in which an action is performed only if some condition is not true. This is done by putting the 'DONT' statement before the DO:

```
IF A=B THEN DONT PRINT "A is
not equal to B" DO
```

Splurge stands for Structured Programming Language with User Restricted Goto Environment, and one of the features is the ability of the user to completely eliminate all GOTO statements. This is one of the main aims of structured programming, and can be achieved at a stroke by the use of the GOTO OFF statement, which causes all subsequent GOTOs to become illegal. GOTO OFF can be cancelled by GOTO ON.

The most exciting statements in Splurge II are the stochastic statements, which cause random effects. The most basic of these is the stochastic GOTO (SGOTO) which causes the program to jump to a random statement.

SGOTO does not normally consider all statements as candidates for the jumps; instead the COME FROM statement is used to mark the lines to which the SGOTO can jump.

For example, the statement 300 COME FROM 200 allows a SGOTO statement at line 200 to cause a jump to line 300, or to any other line with COME FROM 200; SGOTO selects between them at random. SGOTO ANY ignores COME FROM and jumps to a random line.

Stochastic statements are also a feature of procedure calls in Spluge II. The SCALL statement calls a random procedure, and the SRETURN statement RETURNs to a random part of the program. There is also an inverse return statement, IRETURN, which allows return to any statement in the program except the one after the procedure call.

The SHUFFLE statement is another flexible example of Splurge II's versatility. The statement SHUFFLE A, where A is an array, shuffles the array elements, and can be considered to be the opposite of a sort. On its own, the command SHUFFLE shuffles the stack, thus giving rise to a great variety of random events. SHUFFLE PROC shuffles the names of all the procedures. The equivalent statement with strings is A$ = ANAGRAM$ (A$) , which causes a random rearrangement of the string.

Two more statements of tremendous potential usefulness are the REVERSE and GO BACKWARDS statements. The latter causes the program to go from each statement to the statement with the next lowest line number (the opposite direction to normal) starting with the current statement. The REVERSE statement reverses the direction of program flow. Direction of program flow can be evaluated using the two functions FORWARDS and BACKWARDS. If the flow is in the conventional direction, FORWARDS is true and BACKWARDS is false. The reverse is true after a GO

→

Exclusive!

Ron H.J. POETH and SAM MACRAB delve into the unbelievable, and we do mean unbelievable, depths of SPLURGE II, the latest language ROM for the BBC Micro

From Page 65

BACKWARDS statement.

No review of Splurge II would be complete without a description of the splendid Ferret graphics system. Ferret graphics are in many ways similar to Turtle graphics, but there are significant differences. The most important is that, unlike the Turtle which must stay on the flat surface, the Ferret can vanish down holes and reappear elsewhere on the screen. This provides a limited 3D capability. The Ferret is also much faster than the turtle, but not nearly as user friendly.

Normally Splurge II runs under an interpreter which is invoked by typing *SPLURGE. This enters SUE, the Splurge User Environment. SUE also offers a compiler, which allows the program to be executed using the many compiler options designed for rapid debugging.

These options include BOTTOM, which causes the program to be executed from the last statement upwards, and IGNORE, which causes the compiler to ignore all occurences of a specified kind of statement (eg. IGNORE IF).

The SHUFFLE option shuffles all the statements, thus simulating the effect of dropping a deck of cards, a frequent manoeuvre in the days of mainframe batch systems (the same effect can be achieved in Basic by typing REN. 30000), and the CONVERT option changes all occurences of WHILE into REPEAT UNTIL, and vice versa.

The compiler is not exactly compatible with the interpreter, but the program can be converted from the compiler form to the interpreter form by typing the command CFORM and the reverse can be achieved by the command IFORM.

The most powerful feature of the compiler is an improvement of the PL1 defaults system. When PL1 detects an error it guesses a correction and continues. This can cause problems if PL1 guessed wrongly, so Splurge II guesses a correction and enters it as a comment. The command IMPLEMENT COMMENTS, given after a syntax error, causes the guessed corrections to be put into effect.

The Splurge II compiler does not produce machine code directly. Instead, the source code is converted into P-code via an intermediate step called S-code. The P-code is then translated into L-code, U-code, R-code and G-code, which is finally interpreted into E-code or machine code. The Splurge II compiler is unusual in that execution times are in general longer than the times produced by the interpreter.

At the moment Splurge II is suffering minor production problems. The copy presented to us for review is in five EPROMs mounted piggyback, and will only run under operating system 0.1 EPROM.

Despite this, it is only a matter of time before the bugs are ironed out and Splurge II is released on ROM. The language is a worthy successor to BBC Basic, offering facilities that only occur elsewhere in ADA (which is less efficient and needs a much larger machine to run on). It should put someone light years ahead of their competitors.

Oswaldtwistle
1 April, 1983

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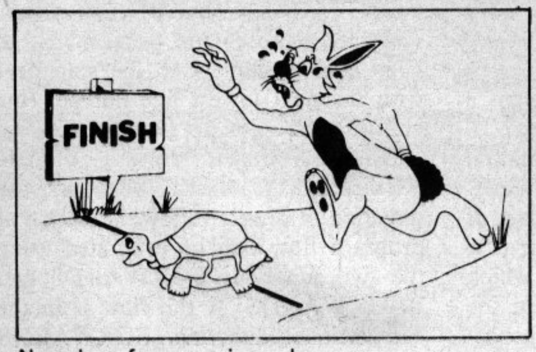

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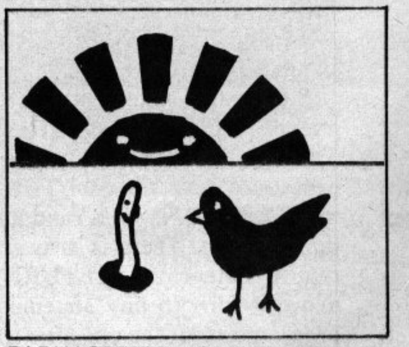

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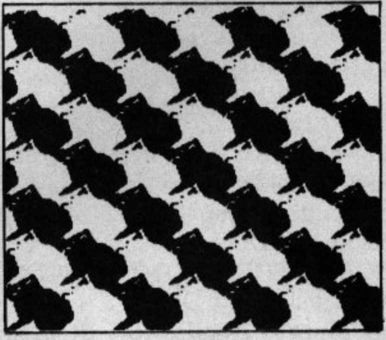

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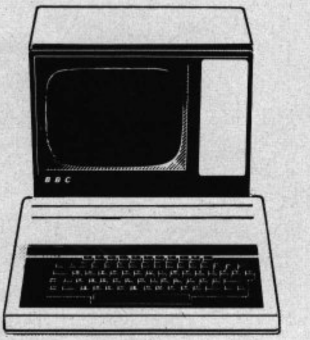

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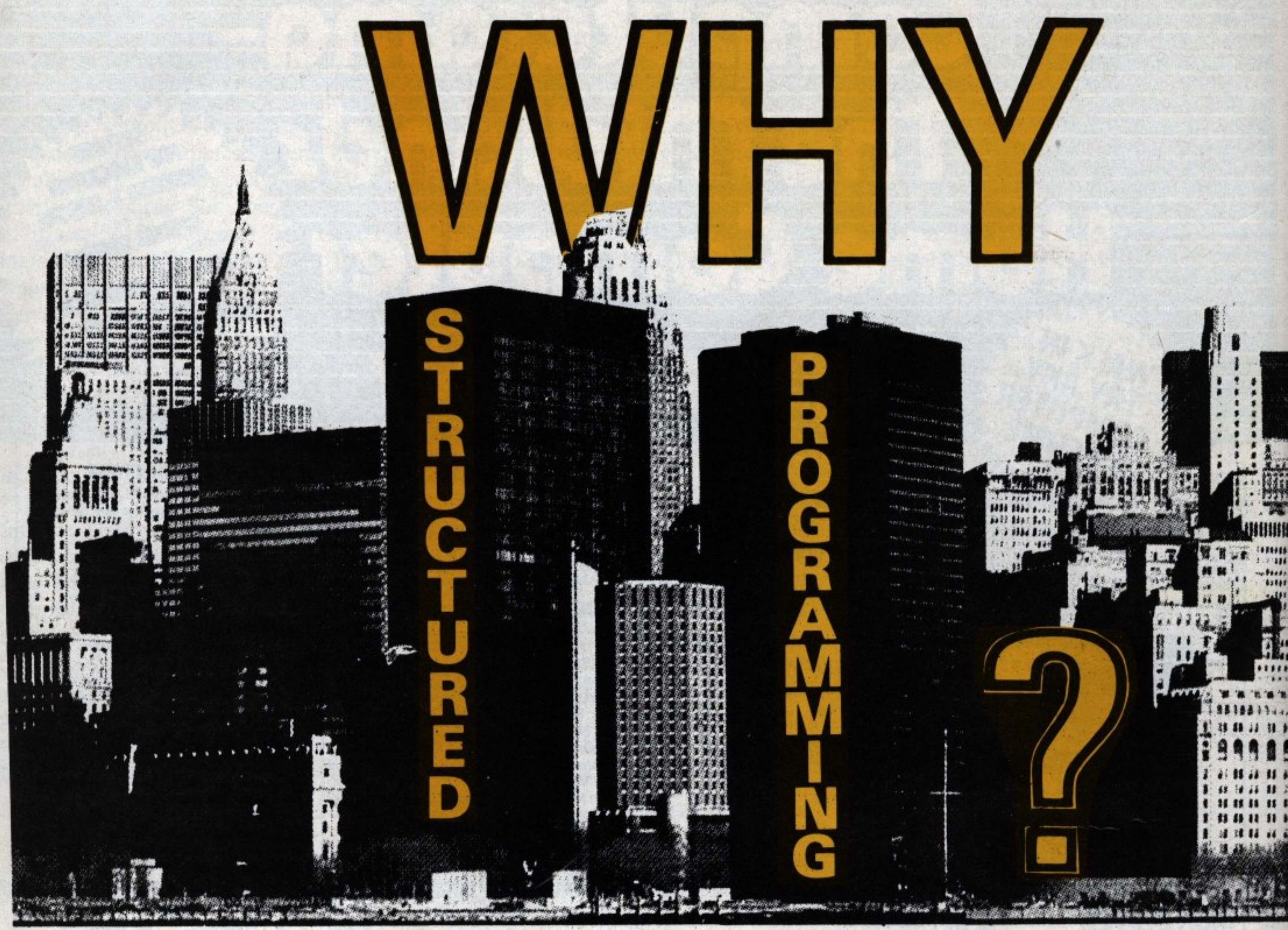


By ROY ATHERTON

> *"Habit is habit, and not to be flung out of the window by any man, but coaxed downstairs a step at a time."*
> Pudd'nhead Wilson – Mark Twain.

IN a recent review of books about programming John Laski observed that "Flowcharts still hang around in syllabuses and codes of practice just because the computing pioneers used them."

Old habits die hard and it would be hard to explain if some people did not still use flowcharts. In view of the persistence of old habits, it is remarkable that most computing professionals and experienced academics find them of little value.

But even if one accepts that structured programming is appropriate for professionals doing large or complex tasks, it may be argued that beginners or amateurs – schoolchildren or the personal computing fraternity – may find the older methods easier and adequate.

These articles will explain the fallacy of this view and show how we can all make the best of our abilities, whether they be high or moderate, by using structured methods. Further, it is important for the intellectual and educational health of the nation that we should do so.

In saying this one agrees with the paragraph about schools in the recent Alvey Report:

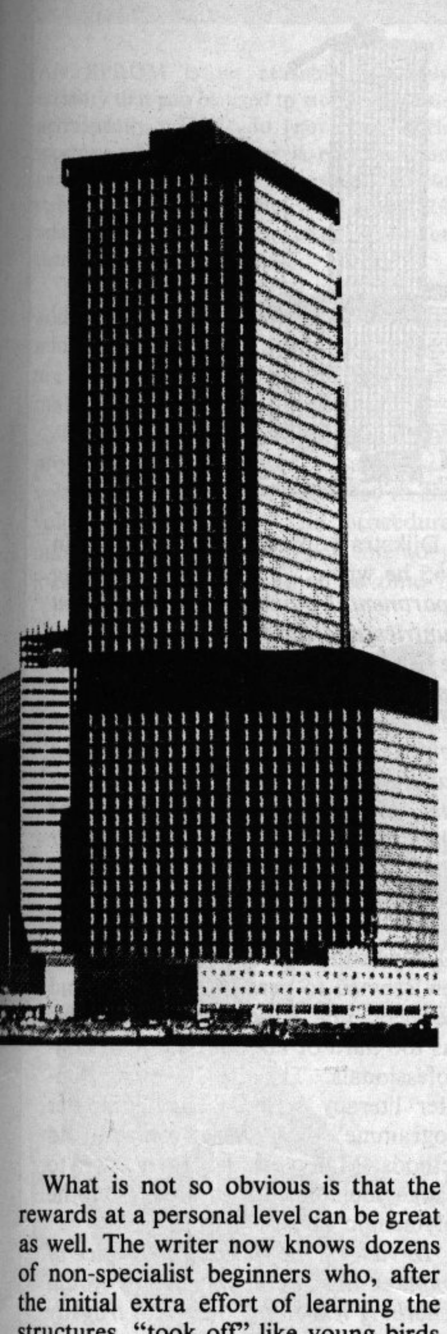
> *"Action must start in the schools. We support the moves which are now putting computing on the curriculum. But, it is no good just providing schools with microcomputers. This will merely produce a generation of poor Basic programmers. Universities in fact are having to give remedial education to entrants with "A" level computer science.*
>
> *"Teachers must be properly trained, and the languages chosen with an eye to the future. Uncorrected, the explosion in home computing with its 1950s and 1960s programming style will make the problem even worse."*

If Alvey and the other opponents of what might be called traditional Basic programming are wrong, then it doesn't matter. A million microcomputers have been sold. We're all learning fast. What is the problem? Why make a fuss?

The problem is that if something is wrong, it is not wrong on a trivial scale. In these circumstances it is worth examining the situation very carefully. If there is a problem and it is a big one, then the rewards for putting it right are correspondingly great.

---

* *Roy Atherton is with Bulmarshe Computer Education Centre.*



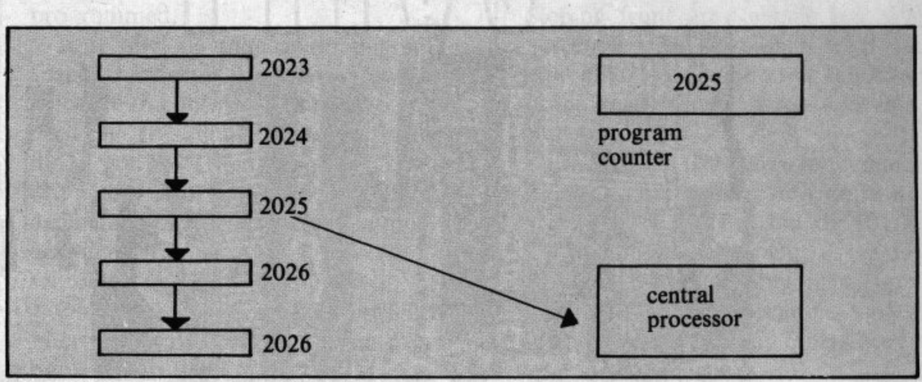


Figure III. Forward jump (decision)

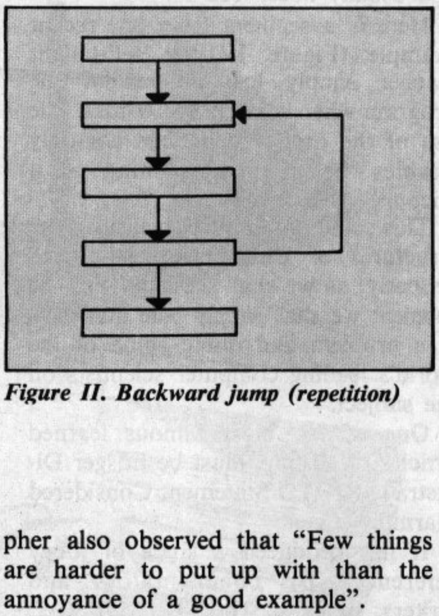


Figure II. Backward jump (repetition)

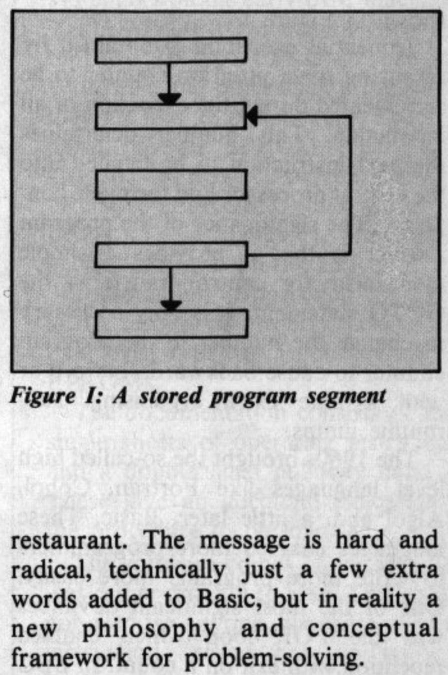


Figure I: A stored program segment

What is not so obvious is that the rewards at a personal level can be great as well. The writer now knows dozens of non-specialist beginners who, after the initial extra effort of learning the structures, "took off" like young birds suddenly able to fly.

The only real proof of that phenomenon is experiencing it or talking to those who have. These articles will take Puddn'head Wilson's advice and try to show, a step at a time, how structured programming came about, what it is and why it is so good – for any programmer at any level.

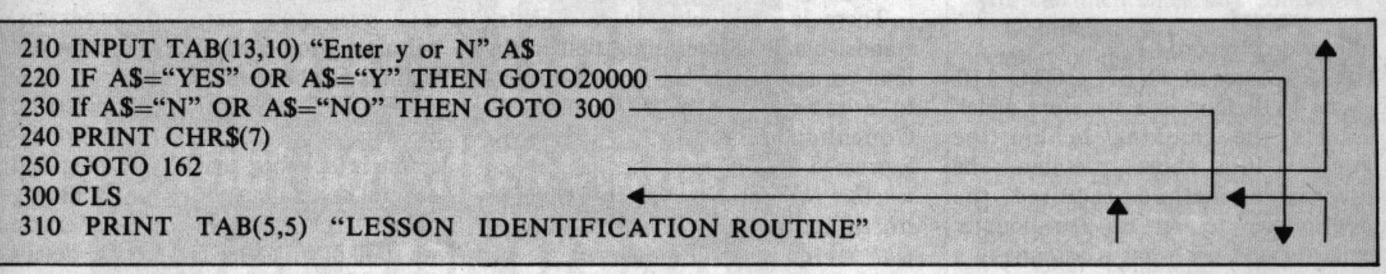
Mark Twain's homespsun philosopher also observed that "Few things are harder to put up with than the annoyance of a good example".

In the leisurely days of the mid-19th century amid the abundant natural wealth of the Southern States of America, Samuel Langhorne Clemens took his pen name from the old Mississippi riverboats. It means "Two fathoms deep", and few would dispute the depth of his wisdom, but we have to move faster than riverboats now.

Having encountered pearls among the dross of outmoded practices, it is no more possible to keep silent than it is to conceal the name of a good restaurant. The message is hard and radical, technically just a few extra words added to Basic, but in reality a new philosophy and conceptual framework for problem-solving.

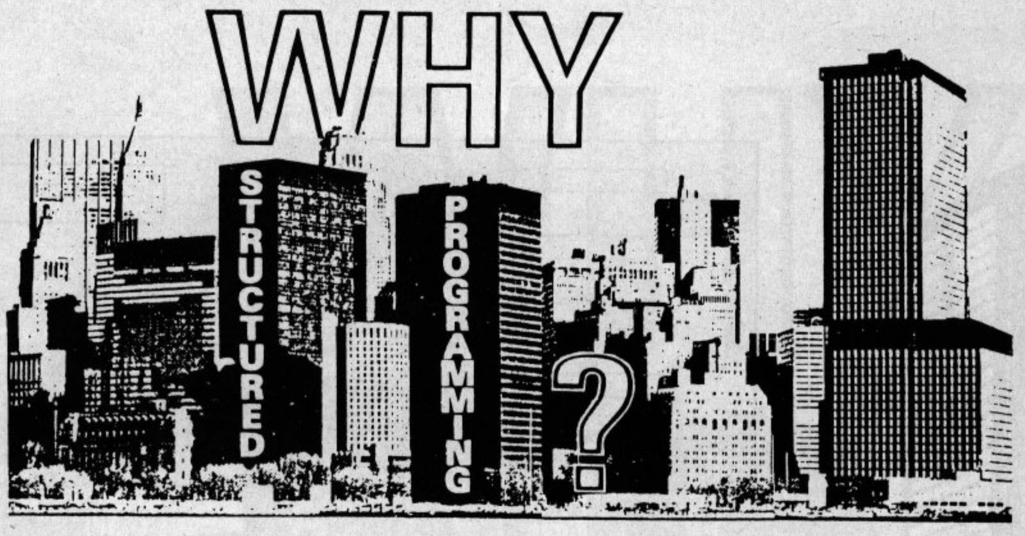
It will be easier to follow and accept in a historical context so we will start with first ideas, a 1950s view of computing.

In those days of glass valve computers, the pioneers used machine code or something close to it. A machine code program is physically a sequence of instructions, and it sits in sequential



```
210 INPUT TAB(13,10) "Enter y or N" A$
220 IF A$="YES" OR A$="Y" THEN GOTO20000
230 If A$="N" OR A$="NO" THEN GOTO 300
240 PRINT CHR$(7)
250 GOTO 162
300 CLS
310  PRINT  TAB(5,5)  "LESSON  IDENTIFICATION ROUTINE"
```

Figure IV: Segment from badly structured program



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memory locations, of which a few are shown in Figure I.

Sequential execution is obtained by arranging for a program counter to be incremented during the execution of an instruction. This number determines the next instruction to be fetched into the central processor and the cycle continues. The significance of the program counter is that it provides a simple mechanism for control transfer – the GOTO statement. It is only necessary to change the number in the program counter to cause backward, forward or with a little extra organising, subroutine jumps.

The 1960s brought the so-called high level languages like Fortran, Cobol, Algol and, a little later, Basic. These languages enabled more programmers to write more programs more easily. One of the most significant advances was the FOR loop which enabled repetition with exit on a count. In BBC Basic this might read:

```
    FOR record = 1 TO 100
        Action on
        record
    NEXT record
```

This achieves repetition without the explicit use of GOTO. Without a FOR structure one could write:

```
100 record = 0
110 Action on
    record
200 record=record+1
210 IF record 10 THEN GOTO 110
```

The FOR loop is a structure which reflects the thinking behind the program. It is about repetition. The alternative method required the programmer to set up the counter explicitly and use what is essentially a binary decision concept to cause the repetition. This does not seem particularly difficult or damaging but we have all seen what using GOTO can, and usually does, lead to.

Here is a segment from one recent example (Figure IV). A self-taught teacher simply lost control of the program when it reached 110 lines. The use of the proper structures not only enables better programming – it encourages it.

This could not happen so easily if the structures of BBC Basic were used properly, as we shall see later. For the moment we shall simply note that there is a problem and quote some of the world's leading computer scientists on the subject.

One of the most famous learned articles of all time must be Edsger Dijkstra's "GOTO Statement Considered Harmful".

It has produced a spate of jokey references by commentators and writers, such as "The Else Must Go" and "Programming Considered Harmful". Dijkstra suggests that:

"... our intellectual powers are rather geared to master static relations ... our powers to visualise processes evolving in time are relatively poorly developed. For that reason we should do ... our utmost to shorten the conceptual gap between the static program and the dynamic process.

"The GOTO statement ... is too much an invitation to make a mess of one's program."

There is no doubt where Dijkstra stands, but it is interesting that in the final paragraphs of his paper he refers to a remark by Heinz Zemanek in Copenhagen, in 1959. Zemanek expressed doubts, even then, as to "... *whether the GOTO statement should be traced on an equal syntactic footing with the assignment statement."*

The ideas had clearly been brewing in Dijkstra's mind for some time. In 1965 he wrote: "... *two programming departmental managers from different countries and different backgrounds – the one scientific, the other mainly commercial – have communicated to me, independently of each other and on their own initiative, their observation that the quality of their programmers was inversely proportional to the density of GOTO statements in their programs. This has been the incentive to try to do away with the GOTO statement."*

Despite the strength of the case the view seemed to persist, in the UK and elsewhere, that structured programming was too hard or not necessary for non-professionals. The BBC's first computer literacy series, "The Computer Programme", was based on the old methods. Many people urged them to change, including 11 lecturers from the Polytechnic of North London:

"In view of the future importance of computer literacy to the UK, it would be nothing less than a national tragedy if thousands upon thousands of eager young minds were introduced to the technology of the 1980s through the modes of thought of the 1960s. It is not too late to reconsider: we urge you to reassess your software policy."

Reconsider they did. Apart from one small lapse, the second series, "Making the Most of the Micro", did not mention the GOTO statement and paid proper regard to structured methods. It is a very good series of programs, certainly good enough to make one feel optimistic about the future.

The BBC joins the Open University, another major institution with an interest in schools, teacher training and general continuing education, in having "gone structured". In the next article we shall begin to see in practical details what this means.

Let's cast some light (but not ultra violet) on EPROMs

AN EPROM is an erasable read-only memory that can be used to store programs permanently. They do not lose their memory when the power is removed and can only be erased by exposing them to strong ultra-violet light for about 20 minutes. This wipes them clean ready for them to be reprogrammed.

To program a memory location, the address of that location is placed on the address pins and the contents required are placed on the pins which are normally outputs.

Then one pin, which is called the program input, is raised to about 25 volts and another pin is subjected to a 5 volt pulse for 50 ms. This procedure must be repeated for each memory location, so it can take some time if several thousand locations are to be programmed.

It is obvious that to do this some special hardware is needed as well as software to control it. As to who might need one, it is almost certainly the case that if you have to ask you don't! However, they can be used for making dedicated computer systems, a plug-in cartridge of your favourite software to sell or to save time loading.

One such package is supplied by Microtrol Engineering Design. It is known as the MEDPROM S3P1 EPROM Programmer and sells for £79. It plugs into the user port of the BBC Micro and also requires connection to the mains.

The unit is professionally built in a sloping front grey plastic box with a screen printed aluminium front panel. The multi-way cable to attach it to the computer is just about adequate in length.

This model is suitable for connection to other computers and software is available for the Pet and UK101, with others in the pipeline. One of the design features is that it only takes up one memory port and so can be connected to the user port. Many others need two or more connections.

The EPROM types that can be programmed are of the 2k variety, 2516 & 2716 and the 4k types, 2532 & 2732. The latter are the ones that hold the EPROM version of operating system 0.1 on the early BBC machines.

The MEDPROM cannot cope with the new 8k type EPROMs that hold Wordwise and other such programs as they are in a 28 pin package. The front panel has an EPROM type-selector switch, a power switch labelled "Remove EPROM", and three red LEDs. These indicate "Mains connected", "Power on the EPROM" and "Programming in operation". There is also a zero force insertion socket of the dual-lever type to accommodate the EPROMs.

The documentation consists of three single sheets of operating instructions and a double-sided publicity handout. These give an adequate indication of the procedure to be followed.

The software comes on cassette and was rather difficult to load. This should not surprise anyone, but there were no instructions about how to make a backup copy using your own recorder, as this often works better than a duplicated tape. The program has been supplied at speeds of 300 baud and 1200 baud to ease this problem. To load and run the program you type:

```
*RUN "MEDPROM"
```

The program automatically loads into the correct location if you only have 16k of memory. Once running you are asked to specify the EPROM type and you can then enter any command.

Commands are available to read a section of the EPROM into memory, display the contents of the EPROM or memory, check that a section has been erased, write a section of memory to EPROM, and finally, to check a section of memory against the contents of the EPROM. All the above require a five letter command (which can be shortened to two), as well as address information in hexadecimal.

When the EPROM is being

programmed it is automatically tested to see whether it is blank and checked afterwards to see if it has been correctly programmed.

During programming, which can take up to four minutes depending upon the length, a constantly moving number is displayed in the lower left hand corner of the screen. This is a particularly nice feature and gives you something to look at while twiddling your thumbs. It also assures you that the thing is still working as four minutes can seem a long time.

As the programming procedure is written in machine code, very little time is wasted and the EPROMs are programmed in the minimum recommended time.

In operation the MEDPROM performed well. I programmed all the types it is capable of and confirmed the contents by testing them against my own system. I have been using EPROMs of one type or another for about eight years and have come across many programming systems. I found this one had a few niggling faults that would not be expected at the price.

First, the zero force socket is not of particularly high quality. It required the EPROM to have its legs straightened before insertion and even then it required some force to push it home. At times the EPROM did not seat properly in the socket and had to be reprogrammed. This is not a fault of the specific socket in the machine I had for review but a general one with that design of socket. With better quality ones available it seems a shame to spoil the ship for a ha'pe'th of tar.

In operation the software was not very user friendly, forcing you to constantly juggle hexadecimal addresses in your head. This is in some respects necessary if you are going to be able to program separate sections of EPROM, but in my experience the whole EPROM is usually programmed at one time.

It would have been quite easy to make a virtual system with a little thought, that is, one where you need not bother about addresses. There is also no means of modifying the contents of the memory, so the MEDPROM would be better described as an EPROM copier. To be fair, this software can link up to a monitor program, MEDMON, supplied by the same firm, but the EPROM programmer is of little serious use without it.

Another criticism is that there is no indication of how the EPROM programmer is squeezed onto one input/output port, and so writing your own software to overcome these shortcomings is made even harder. It was not made clear in the instructions, but it is possible to re-specify the EPROM type and so move the contents of one type of EPROM to another. No re-entry address is given, so the program has to be loaded again once it has been exited.

I found the MEDPROM well-made and sensibly priced. I would have liked to see a better zero force socket and friendlier software, but overall it did perform adequately. You should note that you cannot change any locations unless you have the extra MEDMON monitor program.

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**	*Ease of use*
******	*Performance*

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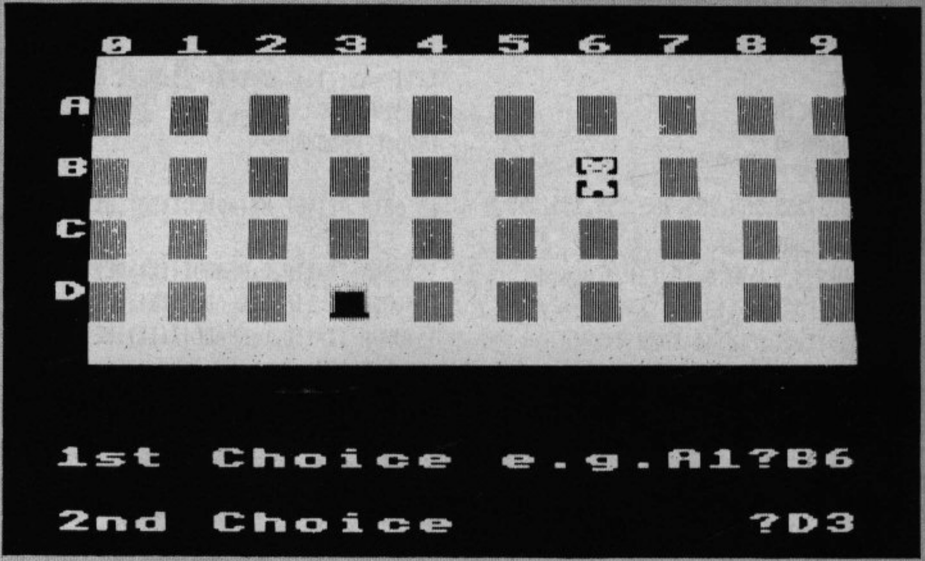
Pelmanism listing

From Page 15

```
))CHR$(B%)
  340COLOUR2:COLOUR128:ENDPROC
  350REM CLEAR PRINT AND COUNT GOES
  360DEFPROCCL:TM%=TIME+200
  370IF A%(P1%)<>A%(P2%) COLOUR1:PROCSND
1:PROCMEM:GOTO390
  380CT%(T%)=CT%(T%)+1:A%(P1%)=0:A%(P2%)
=0:COLOUR2:PROCSND2
  390REPEAT UNTILTM%<TIME
  400PRINTTAB(X1%,Y1%)C$TAB(X1%,(Y1%+1))
C$TAB(X2%,Y2%)C$TAB(X2%,(Y2%+1))C$
  410COLOUR2:ENDPROC
  420REM COMPUTERS TURN
  430DEFPROCCMP:T%=2
  440FOR I%=1 TO TT%-1:B%=M%(I%):IF B%=0
 GOTO510
  450IF A%(B%)=0 GOTO510
  460FOR J%=I%+1 TO TT%:C%=M%(J%):IF C%=
0 GOTO500
  470IF B%=C% GOTO500
  480IF A%(C%)=0 GOTO500
  490IF A%(B%)=A%(C%) J%=TT%:NEXT:I%=TT%
-1:NEXT:GOTO610
  500NEXT
  510NEXT
  520B%=RND(40):IF A%(B%)=0 GOTO520
  530FOR I%=1 TO TT%:IF M%(I%)=B%:I%=TT%
:NEXT:GOTO520
  540NEXT:FOR I%=1 TO TT%:C%=M%(I%)
  550IF A%(B%)=A%(C%) I%=TT%:NEXT:GOTO61
0
  560NEXT
  570C%=RND(40):IF A%(C%)=0 GOTO570
  580IF B%=C% GOTO570
  590FOR I%=1 TO TT%:IF M%(I%)=C%:I%=TT%
:NEXT:GOTO570
  600NEXT
  610P%=B%:J%=(P%-1)/10:I%=P%-1-J%*10:J%
=J%+1
  620A%=254:B%=253:PROCPRT:P1%=P%:X1%=X%
:Y1%=Y%
  630P%=C%:J%=(C%-1)/10:I%=C%-1-J%*10:J%
=J%+1
  640A%=252:B%=251:PROCPRT:P2%=P%:X2%=X%
:Y2%=Y%
  650PROCCL:ENDPROC
  660DEFPROCSND1
  670FOR I%=180TO60STEP-1:SOUND1,-10,I%,
0:NEXT
  680SOUND1,-10,60,2:ENDPROC
  690DEFPROCSND2
  700FOR I%=80TO160:SOUND1,-10,I%,0:NEXT
  710SOUND1,-10,155,2:ENDPROC
  720DEFPROCMEM
  730IF TT%>2 FOR I%=3 TO TT%:M%(I%-2)=M
%(I%):NEXT
```



```
1st Choice e.g.A1?B6

2nd Choice           ?D3
```

```
  740M%(TT%-1)=P1%:M%(TT%)=P2%
  750ENDPROC
  760DEFPROCENDGAME:COLOUR130:COLOUR0
  770PRINTTAB(5,8)"END OF GAME"TAB(6,12)
;
  780IF CT%(1)=CT%(2) PRINT" A DRAW!!"
  790IF CT%(1)>CT%(2) PRINT" YOU WIN"
  800IF CT%(1)<CT%(2) PRINT" I WIN"
  810@%=2:PRINTTAB(4,15)"I Score   :"CT%
(2)
  820PRINTTAB(4,17)"You score :"CT%(1);
  830CT%(1)=0:CT%(2)=0:COLOUR128:COLOUR2
  840PRINTTAB(0,24)SPC(80)TAB(1,27)"SPAC
E to restart:";
  850PROCON
  860I%=GET:IF I%<>32 GOTO860
  870ENDGAME=1
  880ENDPROC
  890DEFPROCOFF:VDU23;10,32;0;0;0;:ENDPR
OC
  900DEFPROCON:VDU23;10,&67;0;0;0;:ENDPR
OC
  910DEFPROCCHAR:L%=D%(Z%)*20
  920GOTO (910+L%)
  930VDU23,A%,60,90,60,24,62,93,93,93
  940VDU23,B%,221,181,84,84,84,148,20,54
:ENDPROC
  950VDU23,A%,0,24,60,60,126,126,255,60
  960VDU23,B%,126,126,255,60,126,255,24,
24:ENDPROC
  970VDU23,A%,0,0,0,0,124,127,125,125
  980VDU23,B%,125,125,127,124,124,124,0,
0:ENDPROC
  990VDU23,A%,0,8,20,54,65,119,54,54
 1000VDU23,B%,20,20,8,8,16,32,32,64:ENDP
ROC
 1010VDU23,A%,0,0,0,0,126,126,126,126
 1020VDU23,B%,126,126,126,126,255,255,0,
0:ENDPROC
 1030VDU23,A%,36,36,60,36,36,36,60,36
 1040VDU23,B%,36,36,60,36,36,36,60,36:EN
DPROC
 1050VDU23,A%,0,0,127,119,119,65,119,119
 1060VDU23,B%,127,64,64,64,64,64,64,0:EN
DPROC
 1070VDU23,A%,0,60,66,66,193,161,159,129
 1080VDU23,B%,129,129,66,66,60,255,255,0
:ENDPROC
 1090VDU23,A%,0,0,0,24,60,126,126,126
 1100VDU23,B%,126,126,60,24,0,0,0,0:ENDP
ROC
 1110VDU23,A%,0,0,0,124,124,124,124,124
 1120VDU23,B%,124,56,16,16,16,56,0,0:END
PROC
 1130VDU23,A%,0,0,124,126,126,9,8,8
 1140VDU23,B%,8,8,8,8,8,8,0,0:ENDPROC
 1150VDU23,A%,0,0,8,8,28,62,127,73
 1160VDU23,B%,8,8,8,8,28,28,0,0:ENDPROC
 1170VDU23,A%,0,20,62,42,62,28,28,62
 1180VDU23,B%,126,122,122,122,250,128,24
0,12:ENDPROC
 1190VDU23,A%,0,0,16,84,124,254,108,254
 1200VDU23,B%,124,84,16,16,16,8,4,0:ENDP
ROC
 1210VDU23,A%,0,102,126,90,126,36,60,255
 1220VDU23,B%,255,60,60,60,126,102,102,0
:ENDPROC
 1230VDU23,A%,0,0,0,112,112,112,112,112
 1240VDU23,B%,112,112,112,124,126,126,92
,0:ENDPROC
 1250VDU23,A%,0,0,0,56,68,56,16,16
 1260VDU23,B%,16,16,16,16,28,24,28,0:END
PROC
 1270VDU23,A%,0,24,16,16,24,52,84,82
```

Pelmanism listing

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```
 1280VDU23,B%,146,145,145,255,255,127,0,
0:ENDPROC
 1290DEFPROCINIT
 1300ENDGAME=0
 1310PROCOFF
 1320VDU23,255,255,255,255,255,255,255,2
55,255:C$=CHR$(255)
 1330VDU19,3,2,0,0,0,19,131,2,0,0,0
 1340T%=1:FOR J%=1TO D%:T%=T%*2:NEXT
 1350TT%=T%:IF TT%>40 THEN TT%=40
 1360VDU12:COLOUR2:PRINT''''" 0 1 2 3 4
5 6 7 8 9";
 1370FORI%=1TO15:PRINT" "STRING$(19,CHR$
255);:NEXT
 1380PRINTTAB(0,7)"A"TAB(0,10)"B"
 1390PRINTTAB(0,13)"C"TAB(0,16)"D";
 1400FOR J%=1TO4
 1410FOR I%=0TO9
 1420Y%=4+J%*3:X%=I%*2+1
 1430COLOUR1:PRINTTAB(X%,Y%)C$TAB(X%,(Y%
+1))C$:COLOUR2
 1440NEXT:NEXT
 1450FOR I%=1TO40:A%(I%)=I%/2+.5:M%(I%)=
0:NEXT
 1460REM SHUFFLE THE CARDS
 1470FOR I%=1TO40:Z%=A%(I%):Z1%=RND(40):
A%(I%)=A%(Z1%):A%(Z1%)=Z%:NEXT
 1480ENDPROC
 1490DEFPROCVBLE
 1500*FX4,1
 1510DIM A%(40),M%(40),C%(20),D%(20),C1%
(20),CT%(2)
 1520FOR I%=1TO20:READD%(I%):NEXT
 1530FOR I%=1TO20:READC%(I%):NEXT
 1540FOR I%=1TO20:READC1%(I%):NEXT
 1550ENDPROC
 1560DEFPROCTITLE
 1570PRINTTAB(7,5)CHR$141CHR$130"**** PE
LMANISM ****"
 1580PRINTTAB(7,6)CHR$141CHR$130"**** PE
LMANISM ****"
 1590PRINTTAB(4,10)CHR$131" Can  you  re
member more"
 1600PRINTTAB(4,11)CHR$131" Pairs than I
 can ?"
 1610PRINTTAB(3,15)CHR$134;
 1620INPUTTAB(4,15)"Choose degree of dif
ficulty(1-6)?"D%
 1630IF D%<1 OR D%>6 GOTO1620
 1640PRINTTAB(3,20)CHR$133;:PIC=0
 1650INPUTTAB(4,20)"Do you wish to see t
he cards(Y/N)?"I$
 1660IF I$="Y" OR I$="YES" PIC=1
 1670ENDPROC
 1680DEFPROCPIC
 1690PROCINIT:A%=254:B%=253
 1700FORI%=1TO40:A%(I%)=I%/2+.5:NEXT
 1710FORI%=0TO9:FOR J%=1TO4
 1720P%=10*(J%-1)+1+I%:PROCPRT:
 1730NEXT:NEXT
 1740PRINTTAB(0,24)SPC(80)TAB(1,27)"SPAC
E to restart:";
 1750PROCON
 1760I%=GET:IF I%<>32 GOTO860
 1770ENDPROC
 1780IF ERR=17 GOTO40
 1790REPORT:PRINT" at line "ERL:END
 1800DATA 1,2,3,4,5,6,7,8,9,10,11,12,13,
14,15,16,17,18,4,18
 1810DATA 1,3,3,1,0,0,1,0,3,1,1,2,0,1,2,
1,1,3,2,1
 1820DATA 0,0,0,0,131,131,0,131,0,0,0,13
1,131,131,0,0,0,0,131,0
```

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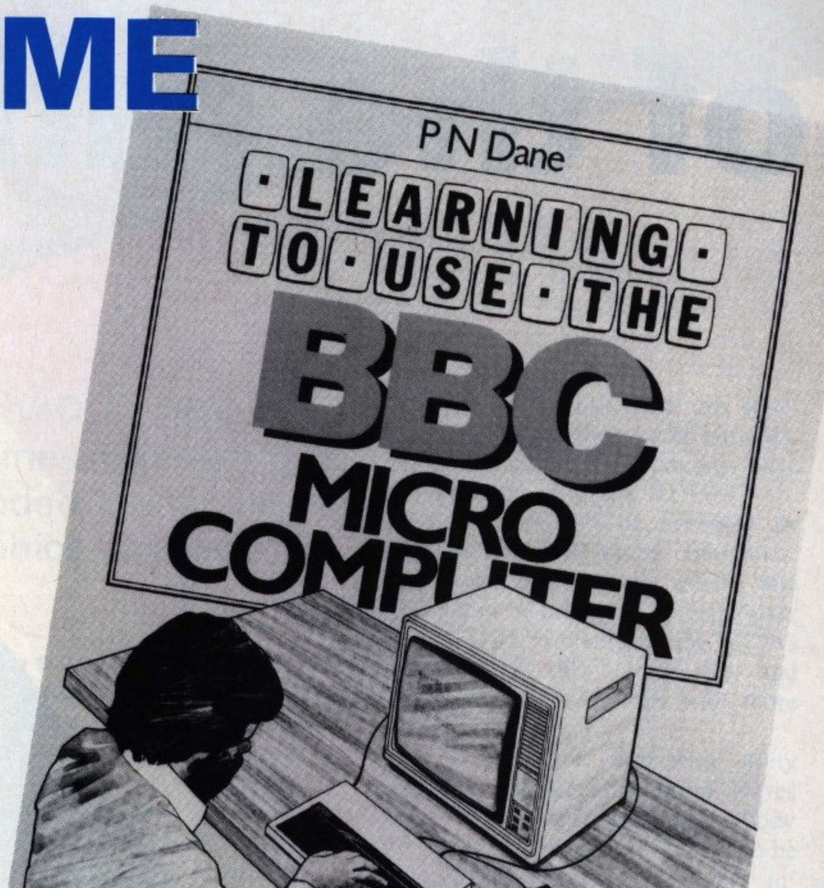

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BBMU5

All the colours of the rainbow

-plus or minus the odd billion!

THE Gaelsett ECFG (extended colour fill graphics) program gives the BBC Micro an extended area colour facility. It operates when the PLOT 81 or 85 commands are executed.

In MODE 2 this gives a claimed choice of 6561 different colours when using the friendly option and a theoretical four billion plus when using the more complex second option.

I am afraid that the latter must remain a theoretical number as I have no intention of verifying each possibility! The program requires only 512 bytes to run but needs another 2048 bytes when loading.

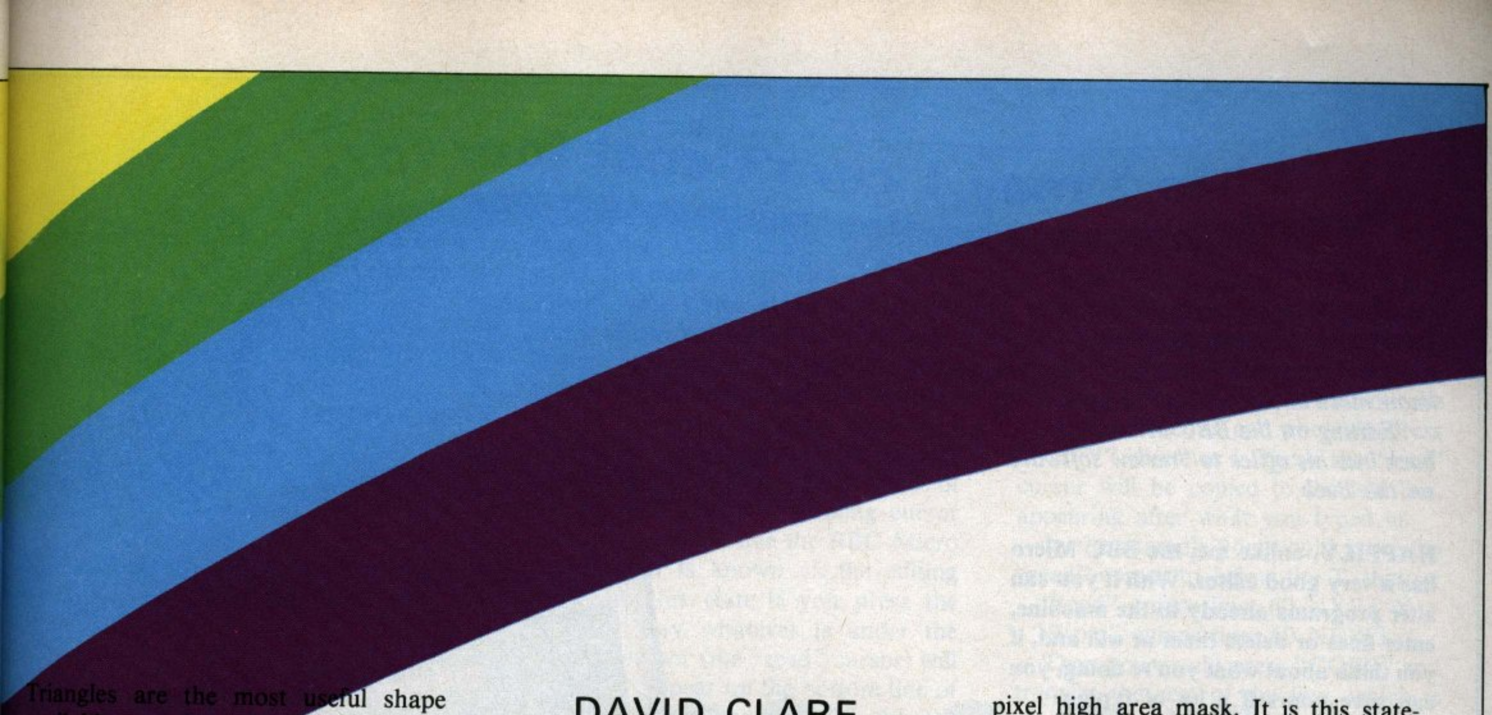
If programs are written to run on all systems with or without the ECFG then tests must be included to establish whether ECFG is present or not.

The large number of colours available means that many cannot be discriminated by the human eye, but in practice a very wide selection of colours is available and in addition to the colours it is possible to create patterns and textures, which can be very useful when drawing complex bar charts or diagrams.

The effect is created by using a much larger colour mask than normally used by the BBC Micro. This allows the user to choose the colour of each individual pixel when using the more complex of the two options, or if the user friendly option is used the user can control the amount of each of the primary colours within an area.

It is the mixing of the various colours within this small area that provides the additional colours. So 50 per cent red pixels and 50 per cent yellow will give orange, or 60 per cent red and 40 per cent yellow will give a deeper orange and so on.

The colours are accessed using the PLOT 81 or 85 commands, which are those used for triangle drawing.



DAVID CLARE examines Gaelsett's extended colour fill graphics package

Triangles are the most useful shape available, as almost any other shape can be made from them.

In the standard BBC Micro the colours for line and area are controlled by a 1 byte (8 bit) line mask that is 1 pixel high by 8, 4 or 2 pixels wide in the 2, 4 or 16 colour graphics modes respectively. So in MODE 2 the line mask is 1 pixel high by 2 pixels wide.

When using the ECFG the PLOT 81 or 85 commands are controlled by an area mask that is 4 pixels high by the normal 8, 4 or 2 pixels wide. Thus the colour mask is made up of 32 bits as opposed to 8, which can each be set to its own individual value giving 2^32 (four billion) possible combinations.

The problem with such a vast number of possible combinations is in being able to predict the results so that they can be made use of. This will become easier as the user gets to know the program better.

Two extra commands are provided to control the effects of ECFG:

VDU18,L,32,C1,C2,C4,C8
and
VDU18,L,64,R1,R2,R3,R4

where L is the logical colour to be defined, C is the amount of colour 1,2,4,8 to be used and R is the range of 1,2,3,4.

The first statement is the user friendly one and is identified by the 32 following L. This instructs the computer to expect and use the values of C1,C2,C4,C8. C1 is red, C2 is green, C4 is blue and C8 is flash, and the values given to them are the proportion of each colour to be used to construct the new colour L.

Red, green and blue are the primary colours that make up all others and flash can be used to introduce grey tones.

For instance, the statement VDU18,0,32,32,32,0,0 will assign logical colour 0 (normally black) to be yellow. The value 32 gives the full intensity of a colour and the above statement tells the computer to use 50 per cent full intensity red plus 50 per cent full intensity green to give yellow.

The intensity and number of the colours used can be altered to provide the 6561 possible colours.

Further investigation shows that in MODE 2 colour 1 is red, colour 2 is green, colour 4 is blue and colour 8 is flash (see page 223 of the User Guide). Colour 3 is yellow. Red(1) + green(2) = yellow(3). It is this type of logic that makes the BBC Micro special and although the logic is not always apparent it is usually there if looked for.

The 64 in the second statement instructs the computer to expect and use values for R1 to R4. The values can be in the range of 0 to &FF(255) and allow binary on/off control of the 4 pixel high area mask. It is this statement that controls the area fill patterns.

Once the colours and patterns have been defined using the VDU18 . . . statement they can be accessed by using the PLOT 81 or 85 commands.

Although some of the effects and colours can be produced by using over range GCOL statements the ECFG program takes this a lot further and gives many more options with more control over them.

As is often the case with utility programs, the documentation leaves much to be desired and anybody purchasing this program will have to be prepared to spend many hours investigating its use. Some demonstration programs are provided, and these can be altered to obtain various effects.

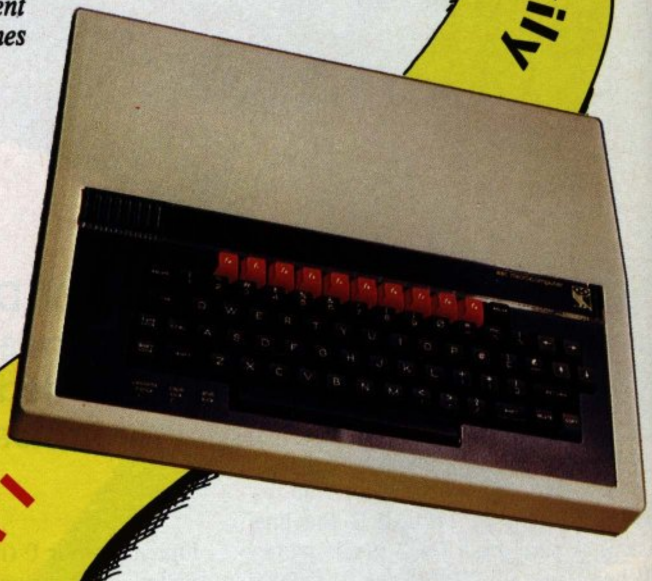
Although the program seems a bit expensive at £10 anybody needing or wanting to use a larger pallette has no real alternative to buying it – and it will do what it claims. However, I cannot help wondering why Acorn did not include these facilities in the ROM along with user friendly methods of using them.

To get an idea of the effects possible enter the following short program which gives some colours not normally available on the BBC Micro:

```
10 MODE 5 (Any graphics mode can be used)
20 X%=0
30 PRINT TAB(2,2)"X%=";X%
40 GCOL X%,1  (Try changing the 1 for other
   numbers)
50 PLOT 85,RND(1000),RND(1000)
60 *FX15,0
70 wait=GET
80 X%=X%+1
90 GOTO 30
```

Each time a key is pressed X% is increased and a new triangle is drawn – try it now.

tri has I may I carn't spel four tofee, but lukily I have a friend to put me right



I SHOULD know by now not to look up when the editor comes in. I did. And he pounced. "You're not doing anything. Earn your keep and write me an article on editing." I say my opening: "Then you admit I know more about editing than you. Why not let me have your job?"

"Editing on the BBC Micro, idiot," came the stuffy reply. He went back into his office to "review software" – his term for playing games on the Beeb.

HAPPILY, unlike me, the BBC Micro has a very good editor. With it you can alter programs already in the machine, enter lines or delete them at will and, if you think about what you're doing, you can save yourself a lot of typing.

The whole point of this editing facility is that you can use it to change things. On one level you are just changing the display on the screen but on another the editing facility changes the program in the machine itself – it actually alters the software. This ability gives the BBC Micro a great deal of its versatility, so it's worth knowing well.

Being human we all make mistakes and, unless you are quite exceptional, you will find yourself making all sorts of typing errors. If you are lucky enough to catch yourself before you press the RETURN key and enter your mistake there is an easy method of correction.

The incorrect line will be the last on the screen, say:

```
10PIRNT"A SILLY ERROR"_
```

with the flashing cursor at the right hand end. All you have to do to rub out an unwanted character is to press the DELETE key which you'll find on the right of the keyboard. The character next to the cursor will disappear to be replaced by the cursor itself. In the example if you press DELETE once this is what you see at the bottom of your screen:

```
10PIRNT"A SILLY ERROR_
```

You can carry on deleting right the way up to the command prompt " > ", the cursor moving to the left each time. You'll probably have noticed that keeping the delete key pressed makes it repeat its function, rubbing out the line from right to left. Once you have erased the error you just type in the correct characters. When satisfied with the corrected line press RETURN as usual.

This is quite simple, but if you have a long line with the mistake at the beginning you may feel that deleting it all takes too long. Once again the BBC Micro comes to the rescue. If you want to get rid of the bottom line entirely just press the CTRL key (on the left of the keyboard) and the letter U at the same time. The bottom line with all its characters will disappear and you can retype the whole line.

Sadly, all of this is no good to you if you have already entered an incorrect line. Suppose you had something like:

```
50 PIRNT "A SILLY MISTAKE"
```

actually in a listing. Obviously it will have to be corrected. "PIRNT" should be "PRINT". How do you go about changing what is already in the machine? The delete button won't work once you have pressed RETURN and the line is part of a listing.

By NIGEL PETERS

You have two alternatives. The straightforward one is to get rid of the incorrect line 50 by typing in the correct line 50, that is, you type in:

```
50PRINT "A SILLY MISTAKE"
```

press RETURN, and the machine accepts the new line.

This is easy, but can be a bit laborious. Imagine a line of some 200 characters, only one of which was wrong! It would be far too time consuming to have to re-type the whole 200 characters for one mistake, so now is the time to make use of the second alternative.

If you look to the right of the keyboard you will notice some light brown keys. Four have arrows on them and one is marked "COPY". The keys with arrows are the cursor controls and, with the "COPY" key, you can use them to alter program lines quickly and easily.

Type in the following program, which will be used for examples throughout the article. I know it doesn't look very neat but bear with me for now, I'll be doing something about it later. Since this article is about correct-

Editing can be easy

ing mistakes, it might help if you made a few errors, deliberate or otherwise!

```
10 REM EXAMPLE
20 Y = 1
30 REPEAT
40 FOR X = 1 to 5
50 PRINT "BBC MICRO USER
   RULES, O.K?"
60 NEXT X
70 Y = Y + 1
80 UNTIL Y = 3
```

Suppose we had typed in and entered

60 NXET X

and we want to correct it. In this case it would be easy to type in a new, correct line 60, but let's try using the cursor keys and "COPY".

Start with the four cursor keys, "↑", "↓", "←", "→". Press them a few times and you'll notice that the flashing cursor moves round the screen (leaving a white block at the bottom of the screen which we'll ignore for the moment).

The cursor moves in the direction indicated on the key you press. If you press the "↑" key the cursor moves up one line, If you press the "→" key the cursor moves one space to the right. I leave it to you to find out what the "↓" and "←" keys do to the flashing cursor. You will notice that if you keep a key depressed it repeats its function and the cursor can shoot off one side of the screen to reappear at the other.

Normally the flashing cursor stays on the bottom line showing where the next character you type in will appear. When it goes on its travels about the screen under the influence of the cursor keys it loses its ability to show where the typing goes. It becomes what is known as the "read" cursor and I'll explain what it reads in a moment.

Meanwhile, what about the white square that stayed stubbornly on the bottom line while the cursor wandered? It appeared in the place where the flashing cursor was before we sent it off on its travels and it's called the "write" cursor.

Ignoring the flashing "read" cursor, try typing in a few characters. You will see that they appear on the bottom line of the screen, the "write" cursor moving to the right along the line showing where the next character will appear. In fact the "write" cursor behaves just like the flashing cursor did when it was on the bottom line. You can even use the "DELETE" key to erase the bottom line, the "write" cursor moving to the left.

So, I've got a flashing 'read' cursor that I can move around the screen using the cursor keys and I've got a square 'write' cursor on the bottom line which allows me to type in characters in the usual way. "How can I use these to correct my mistakes?" you might ask.

This is where the "COPY" key comes in. When, under the influence of the arrowed keys, the flashing cursor leaves the bottom line the BBC Micro enters what is known as the editing mode. In this state if you press the "COPY" key whatever is under the flashing cursor (the "read" cursor) will magically appear on the bottom line of the screen, written by the "write" cursor. It will have been copied!

Like most things on the BBC Micro, it is a lot easier to do than to read about, so let's have a bit of practice. Suppose we want to correct a line in a listing that looks like this:

60 NXET X

Use the cursor keys to position the "read" cursor under the "6" of the "60". Now press the "COPY" key and two things happen. The flashing "read" cursor moves one character to the right and at the same time the 6 appears on the last line of the screen, the "write" cursor moving to the right as well. For example:

	Before pressing "COPY"	*After*
"Read" cursor (anywhere on the screen)	6̲0 NXET X	60̲ NXET X
"Write" cursor (last line)	□	6□

Press "COPY" again and the same thing happens with the 0. Using the "COPY" key you can copy the whole line to the bottom of the screen, but this would be a little silly, as all you would be doing would be to duplicate your original mistake!

What you do is use the "COPY" key to read the incorrect line and copy it to the bottom line up to where the mistake occurred. Then you can type in the correct characters which appear on the bottom of the screen. You'll notice that when you type in characters the "write" cursor moves to the right as normal. The "read" cursor stays put.

In the example you would COPY up to where the "read" cursor was below the "X"

"Read" cursor line: 60 NX̲ET X
"Write" cursor line: 60 N□

Then you would type in the correct characters, for example:

"Read" cursor line: 60 NX̲ET X
"Write" cursor line: 60 NEX□

You can then move the "read" cursor to wherever you want it to be on the screen, that is, past the mistake onto the correct bit and when you press "COPY" whatever is above the "read" cursor will be copied to the last line, appearing after what you typed in.

In the example you would move the "read" cursor to below the T, that is:

"Read" cursor line: 60 NXET̲ X
"Write" cursor line: 60 NEX□

Then you would press "COPY" and transfer the rest of the line, which is correct, to the bottom. Press "COPY" and you get:

"Read" cursor line: 60 NXET_X
"Write" cursor line: 60 NEXT□

and so on until the bottom line is correct. Then all you do is press RETURN in the normal way, the new correct line is entered and the flashing cursor appears next to the command prompt as usual. Editing mode has ended.

Although the example was fairly trivial, you can imagine that with a long line with only one error, using "COPY" is a lot easier than retyping the whole line. Also, by paying attention when typing in listings, using "COPY" can save you a lot of typing.

Imagine a program like:

```
200 PRINT "ABCDEFG"
210 PRINT "ABCDEFGH"
220 PRINT "ABCDEFGHI"
```

You could type in each line separately, but wouldn't it be easier just to copy line 200 with a few modifications to produce 210 and 220? A little practice and forethought can save a lot of typing.

Anyway, enough of cursor keys and "COPY". If you want practice try putting all the words and numbers that formed the example program on one line using cursor keys and "COPY". Then from that one line try recreating the original program with no typing in allowed. I guarantee that you'll be an expert by the time you have finished that!

Which is more than can be said for my editor . . .

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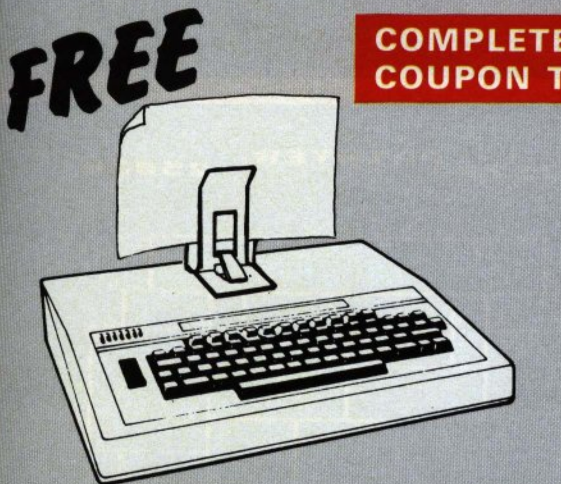

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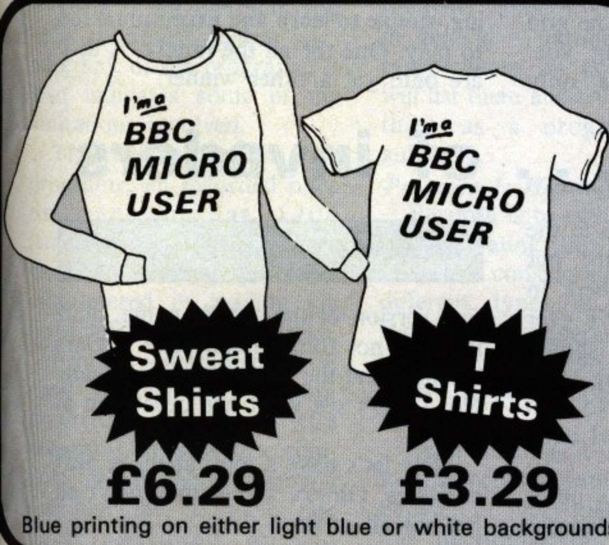
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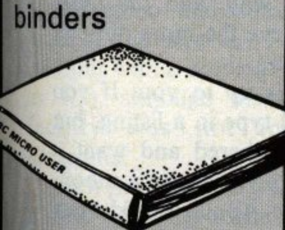

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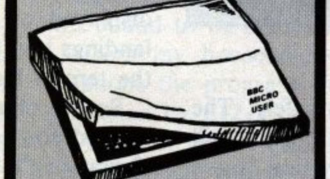

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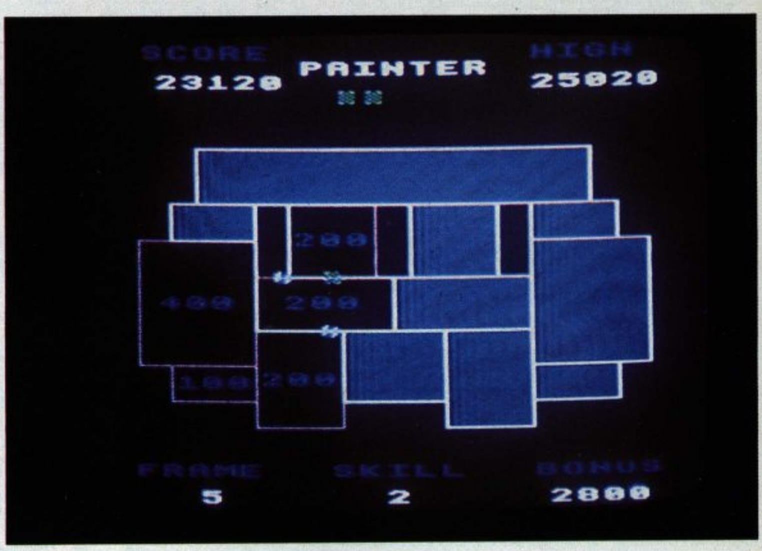

Painter (A&F)

PAINTER is a sheer delight to play – a compulsive, fast-action game and far more refined than the usual "bang 'em, shoot 'em" arcade type.

It is hard to convey the excitement of the game in words. You simply move your man round a grid composed of rectangles, leaving a trail behind you. When your trail surrounds a rectangle it is "painted in", and you score a varying number of points.

However, while you're doing this you are pursued by a creature intent on destroying you. Your aim, of course, is to avoid that fate while achieving as high a score as you can.

On the lower levels, the beastie is relatively unintelligent and scoring is rather easy. However, once you've filled in all the scoring rectangles, you move onto a new, more complex grid, and the creature's IQ increases.

Worse still, as you ascend the skill levels, more creatures appear in pursuit. I am sure whoever thought of this game had the DTs at the time. To counter this, you can "break" the grid line to prevent them following you. While the respite gained is only temporary, there's an immense satisfaction from using two such breaks to bottle one of the enemy up – it goes wild with frustration!

The game is beautifully designed from every angle. It is visually appealing, simple to learn and exceptional fun to play. One for all the family. A & F are onto yet another winner.

Invasion . . . of invaders

Invaders (Software Invasion)

I'M sorry if this review isn't up to the usual BBC Micro User standard, but I'm not one of the regular reviewers. In fact this is the first review I've ever done. You see the person who should be doing it was last seen running away from the office screaming "No, not another Space Invaders game, I can't take it any more."

I don't understand what has upset him. Software Invasion has produced a fine version of the arcade game, quite fast but not too difficult. The colours are nice and the instructions adequate. No, I can't see what has upset him at all.

Now let's have a look at those next cassettes. Oh no, surely they can't all be, not all of them . . .

Basic, but busy, moonlander

Apollo (Software Invasion)

"WHY?", I asked myself, as I loaded Software Invasion's Apollo, "should anyone bother producing a moonlander game when there are lots of listings available?"

The graphics didn't help my doubts. They were adequate but hardly made full use of the BBC Micro's facilities. No, there didn't seem much point in the exercise.

But having said that I kept on trying to land the lunar module safely. The game may be an old idea but it's still fun, and Software Invasion have produced a competent easy-to-play version.

You take the Apollo craft from orbit round the moon to a, hopefully, safe landing, four different screens being displayed on the way, and the more landings you achieve the more difficult the terrain becomes.

So the choice is up to you. If you wanted you could type in a listing, but if you can't be bothered and want a basic but adequate version of a moonlanding game then Apollo would meet your needs.

By MARGARET TURNBULL

Not the best banner bearer

Home Finance (BBC Soft)

HOME Finance, marketed by BBC Soft and created by the Consumers' Association (the publishers of Which?) is a colourful, presentable package, containing a booklet and cassette.

The booklet is clearly written and gives you fair warning of all the facts you need to amass before running any of the programs. It also indicates some of the limitations involved.

The cassette contains four programs, all recorded once on one side at 1200 (standard rate) baud. There were no loading problems encountered in loading via three different cassette decks.

From a software point of view I was very disappointed. None of the programs initialised the computer in any way, presuming the machine to have just been switched on, so problems could be and were encountered by the machine being in the wrong MODE/ screen-scroll set/ the effects of cursor-control keys etc.

The only BBC micro facilities utilised were occasional double-height characters, a little background colour and the acceptance of numbers (say 1.5) to be input with a comma (such as 1,5), although the latter facility was not in all programs.

Each program did contain a good REM list at the start, defining the intended use of all variables, but the code overall was ponderous, inefficient in many places (in Basic terms) and, would you believe, not a PROC in sight!

I found all four programs very poor examples to carry the BBC banner to the public in general – particularly to those whom on acquisition will list them and try and use them as a programming guideline.

Program I: Heating

Purpose is to estimate the cost of heating your home. It takes into consideration eight different types of heating system, the temperature and time duration required, and a fairly detailed definition of the house.

Before running it you need to arm yourself with a large number of facts (detailed in the accompanying book) such as the cost of various fuels, the area of your floors, windows, roof and construction.

As most households are heated by more than one source, and the program only offers a single option system, the results obtained are bound to be inaccurate.

From my household calculations the program overestimated by £12 a month.

After the initial result has been attained you can alter the fuel/hours/temperature and quickly see what the net effect would be.

It would have been nice if single/double glazing and draughty/not draughty options had also been included in this list.

I found the initial question and answer system very offputting in that there was a constant screen full of text as the program scrolled forever onwards. (And why should Yes or No be answered by typing 1 or 2?)

Program II: Rent/buy

This enables you to compare the costs involved in renting an item as opposed to an outright purchase, over a period of five years. It does not facilitate credit purchases, or items where tax relief may be gained.

Within the calculation it does take into consideration such things as the rate of inflation, rate of lost interest, annual service contracts and the secondhand resale value.

The initial questions were asked in a scrolling screen mode and the results table was reasonably presentable after jumping its way to the top of the screen.

However my copy of the program contained a mathematical error within the rental calculation (a TV rented at £180 per year for five years would have cost £2,470!)

Program III: Borrowing

The intention of this program is to help you select a suitable source from which to borrow money.

You can borrow up to £999,999 with repayments at any one of five methods per year (weekly, monthly, etc). Repayment period, rate of interest and tax relief are all taken into consideration.

The results are tabled, showing how much it will really cost you and the effective interest rate after tax relief, if applicable.

Not an inspiring program, the maths is pretty basic, but no doubt included in the package for completeness.

Program IV: Saving

This program attempts to show the interest you will acquire when saving either a lump sum of money or by regular payments.

It shows a fairly wide cross-section of options and takes into account tax and inflation rates.

You will have to keep changing the interest rates to keep up to date, as the program starts with a set from last year.

Again the screen scrolled on, but for a brief moment you do get a second colour.

Summary

My initial enthusiasm when presented with this impressive package rapidly evaporated due to the unimpressive screen usage and program discrepancies.

I feel, as both a householder and home economics teacher (covering these subjects), that the package falls somewhat short of value for money.

TELETEXT MODE 7

From Page 19

Program III

```
 10 MODE 7: VDU23;8202;0;0;0;
 20 DIM A$(14),R%(3,7)
 30 REM
 40 REM Use FNget to read data and
 50 REM form string array.
 60 REM
 70 FOR L%=0 TO 14
 80 A$(L%)=FNget
 90 NEXT
100 REM
110 REM Read in each frame's formation
120 REM
130 FOR I%=1 TO 3
140 FOR J%=0 TO 7
150 READ R%(I%,J%)
160 NEXT J%
170 NEXT I%
180 INPUT"DELAY",WT
190 REM
200 REM Yellow background, then window
210 REM
220 FOR I%=0 TO 23:PRINT CHR$147:NEXT
230 VDU 28,1,23,39,0
240 FOR X%=0 TO 24 STEP 6
250 PROCput(X%,1):PROCdelay
260 IF X%=24 THEN 290
270 PROCput(X%+2,2):PROCdelay
280 PROCput(X%+4,3):PROCdelay
290 NEXT
300 INPUTTAB(0,2)"REPEAT "AN$
310 IF LEFT$(AN$,1)="Y" THEN VDU 26,12
GOTO180
320 END
330
340 DEF PROCput(P%,F%)
350 FOR J%=0 TO 7
360 PRINTTAB(P%,J%+10)A$(R%(F%,J%))
370 NEXT
380 ENDPROC
390 DEFPROCdelay
400 now=TIME
410 REPEAT UNTIL TIME-now>WT
420 ENDPROC
430 DEFFNget
440 Z$=""
450 READ Q$
460 FOR I%=1 TO 23 STEP 2
470 Z$=Z$+CHR$(EVAL("&" + MID$(Q$,I%,2
))
480 NEXT
490 =Z$
500 DATA A0A0A0A0A0A0A0FCB0A0A0
510 DATA A0A0A0A0A0A0A0EAFFFDA4
520 DATA A0A0A0A0A0A0E0FFF7B0A0
530 DATA A0A0A0A0A0E8FFFFA1A0A0
540 DATA A0A0A0A0E0FEFFFFB4A0A0
550 DATA A0A0A0E0F8FFBFEBBFA1A0A0
560 DATA A0A0B8A7A3A1A0A2EDA0A0A0
570 DATA A0A0A0A0A0A0A0A2A0A0A0
580 DATA A0A0A0A0A0A0A0A0A0A0A0
590 DATA A0A0A0A0E0FEFFFFFFA0A0
600 DATA A0A0A0F0F8FFBFA3FFA1A0A0
610 DATA A0A0A3A1A0A0A0A0A3ADA0A0
620 DATA A0A0A0A0A0E8FFFFF1A0A0
630 DATA A0A0A0A0E0FEFFFFBFA0A0
640 DATA A0A0F0F0FCFFBFEBF7F0A0A0
650 DATA 8,8,0,1,2,12,13,14
660 DATA 8,0,1,2,3,9,10,11
670 DATA 0,1,2,3,4,5,6,7
```

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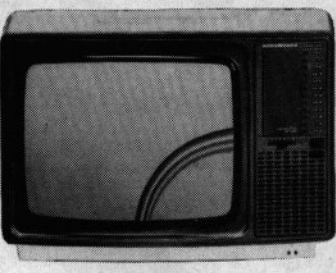

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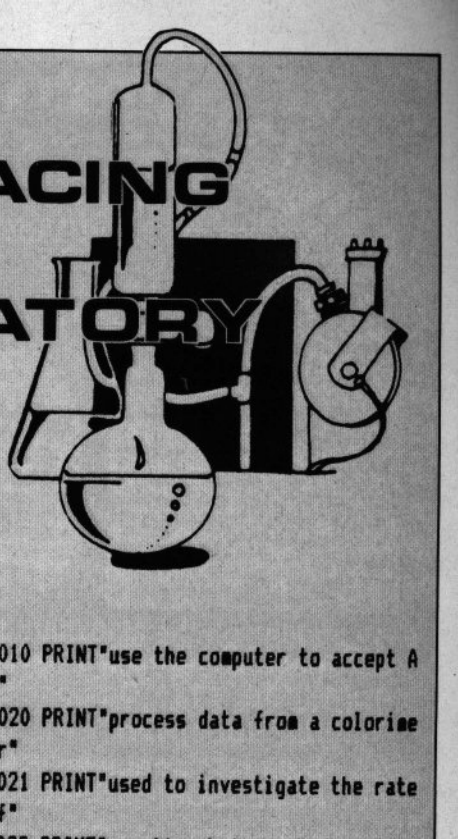

From Page 21

```
  270 PRINT" chloric acid into a test-tu
be"
  280 PRINT"Into another test-tube measu
re out";thio(S);" ml.of Sodium";
  290 PRINT" thiosulphate and ";water(S)
; "ml.of water "
  300 PRINT:PRINT:PRINT
  310 PRINT"Pour the acid CAREFULLY into
 the sodium ";
  315 PRINT"thiosulphate solution "
  316 PRINTCHR$131;CHR$157;CHR$132;SPC(5
)"PRESS SPACE-BAR QUICKLY"
  320 IF GET =32 THEN 330 ELSE 320
  330 SOUND1,-15,150,2:*FX15,1
  340 TIME=0
  350 Now=TIME /100
  360  PRINT"START TIME= "; Now;" SECOND
S"
  370 PRINT:PRINT"Place reagents into co
lorimeter and set to 100% transmission"
  380 PRINTCHR$131;CHR$157;CHR$132;"PRES
S SPACE-BAR QUICKLY WHEN READY"
  390 IF GET =32 THEN 400 ELSE 390
  400  VDU7: *FX15,1
  420 REPEAT UNTIL ADVAL(2)<30000
  430
  440 finish(S)=TIME/100
  450 PRINT "FINISH TIME= "; finish(S) ;
 " SECONDS"
  460 PRINTTAB(2,22);"PRESS SPACE-BAR TO
 CONTINUE"
  470 IF GET=32 THEN 480 ELSE 470
  480 SOUND1,-15,150,2:*FX15,1
  490 ENDPROC
  500 DEF PROCRESULTS
  510 CLS
  520 PRINTTAB(0,3)CHR$(141);CHR$131;CHR
$157;CHR$132;SPC(8)"TABLE OF RESULTS"
  530 PRINTTAB(0,4)CHR$(141);CHR$131;CHR
$157;CHR$132;SPC(8)"TABLE OF RESULTS"
  540 PRINTCHR$(141);CHR$(131);CHR$(157)
;CHR$(132);STRING$(28,"=")
  550 PRINT:PRINT:PRINT"VOL.OF THIO.  TI
ME(SECS)  1/TIME(SECS) "
  555 PRINT STRING$(40,"=")
  560 @%=&0002020A
  570 FOR S=1 TO series
  580 PRINTthio(S),finish(S),1/finish(S)
  590 NEXTS
  600 PRINTTAB(2,22);CHR$131;CHR$157;CHR
$132;SPC(4)"PRESS SPACE-BAR TO CONTINUE"
  610 IF GET =32 THEN 630 ELSE 610
  620 *FX15,1
  630 ENDPROC
  640 DEF PROCGRAPHICAL_2
  650 @%=&10
  660 LOCAL SCALE
  670 SCALE=2000
  680 VDU5  :CLS
  690 MOVE 0,1000
  700 DRAW 0,0:DRAW 1280,0
  710 FORS=1 TO series
  720 MOVE thio(S)*100,1/finish(S)*SCALE
+40:PRINT"*";S
  730 NEXTS
  740 VDU 4
  750 PRINTTAB(2,3);"PRESS SPACE-BAR"
  760 IF GET =32 THEN 770 ELSE 760
  770 PROCOPTION
  780 ENDPROC
  790 DEF PROCGRAPHICAL_1
  800 @%=&10
  810 LOCAL SCALE
  820 SCALE=10
  830 VDU5  :CLS
  840 MOVE 0,1000
  850 DRAW 0,0:DRAW 1280,0
  860 FORS=1 TO series
  870 MOVE thio(S)*100,SCALE*finish(S)+4
0:PRINT"*";S
  880 NEXTS
  890 VDU 4
  900 PRINTTAB(4,30);"PRESS SPACE-BAR"
  910 IF GET =32 THEN 920 ELSE 910
  920 PROCOPTION
  930 ENDPROC
  940 DEF PROCTITLE
  950 *FX15,1
  960 PRINT:PRINT :PRINT
  970 PRINTCHR$(141);CHR$(131);CHR$(157)
;CHR$(132);"A PROGRAM FOR A COLORIMETER"
  980 PRINTCHR$(141);CHR$(131);CHR$(157)
;CHR$(132);"A PROGRAM FOR A COLORIMETER"
  990 PRINTCHR$(141);CHR$(131);CHR$(157)
;CHR$(132);STRING$(28,"=")
  995 PRINTCHR$(141);CHR$(131);CHR$(157)
;CHR$(132);STRING$(28,"=")
 1000 PRINT:PRINT"This program will allo
w you to"
 1010 PRINT"use the computer to accept A
ND"
 1020 PRINT"process data from a colorime
ter"
 1021 PRINT"used to investigate the rate
 of"
 1022 PRINT"reaction between hydrochlori
c acid"
 1023 PRINT"and sodium thiosulphate."
 1030 PRINTTAB(5,20);CHR$136;CHR$131;CHR
$157;CHR$132 ;SPC(5);"PRESS SPACE-BAR"
 1040  IF GET=32 THEN 1050 ELSE 1040
 1050 SOUND1,-15,100,2 :*FX15,1
 1060 ENDPROC
 1070 DEF PROCOPTION
 1080 CLS :COLOUR3
 1090 PRINT TAB(0,2);"THIS COMPUTER PLOT
S TWO TYPES OF GRAPH"
 1100 PRINT"EITHER "
 1110 PRINT"(1) CONCENTRATION AGAINST TI
ME"
 1120 PRINT"OR"
 1130 PRINT"(2)CONCENTRATION AGAINST 1/T
IME"
 1135 VDU19,2,11,0,0,0
 1140 PRINT:COLOUR2:PRINT "SELECT 1,2 FO
R GRAPH OR 3 TO STOP"
 1160 INPUTAnswer
 1165 VDU23 ;8202;0;0;0;
 1170 IF Answer=1 THEN PROCGRAPHICAL_1
 1180 IF Answer=2 THEN PROCGRAPHICAL_2
 1190 IF Answer=3 THEN ENDPROC
 1200 IF Answer <>1 AND Answer <>2 AND A
nswer<>3 THEN PRINT "PRESS 1 OR 2 OR 3":
GOTO 1160
 1210 ENDPROC
```

Program III

```
10 MODE0
20 *FX16,1
30 FOR X%=0 TO 1200
40 DRAW X%,ADVAL(1)DIV55
50 NEXTX%
```

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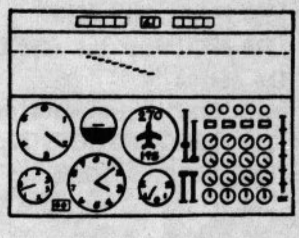

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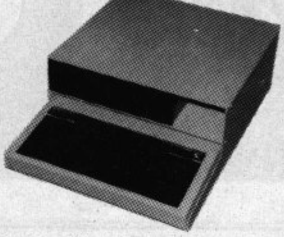

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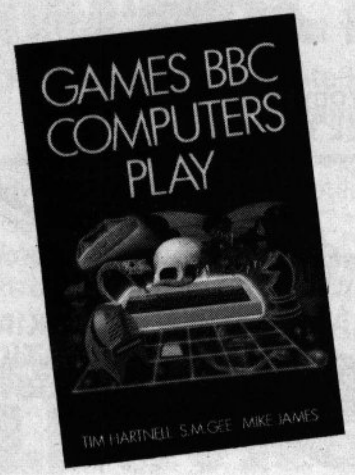
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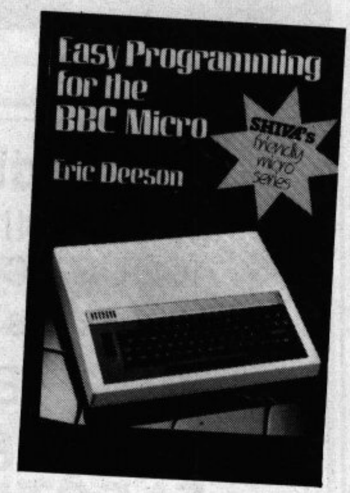
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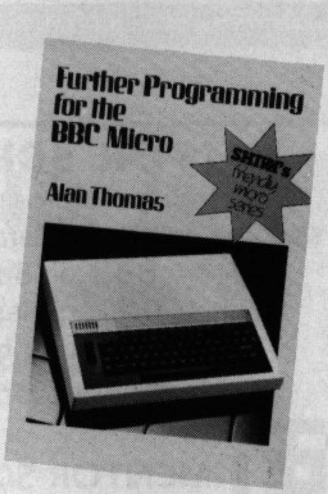
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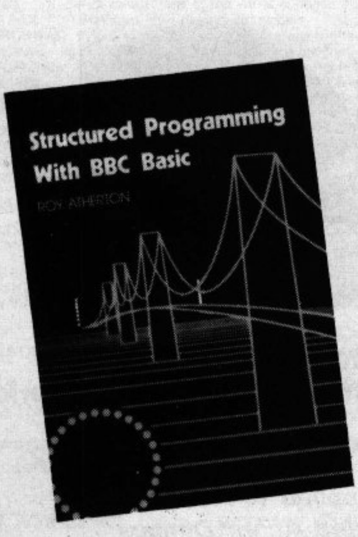
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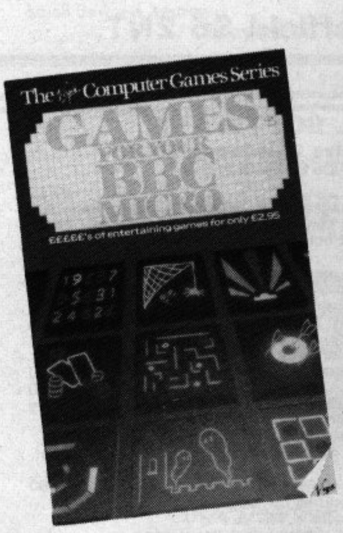
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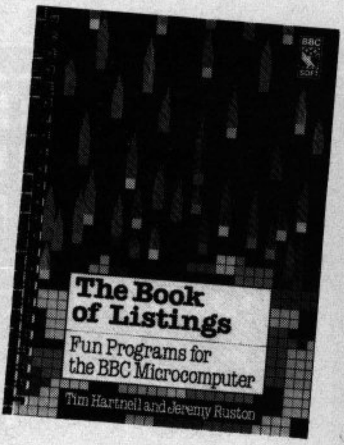
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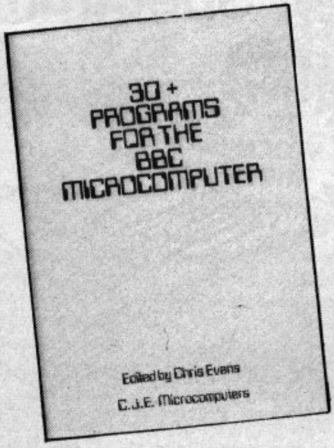
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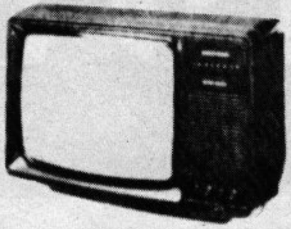

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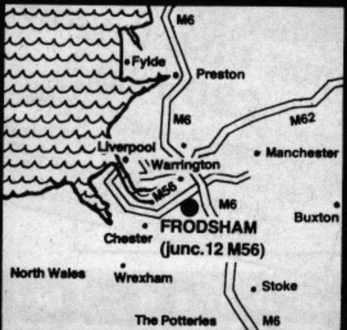

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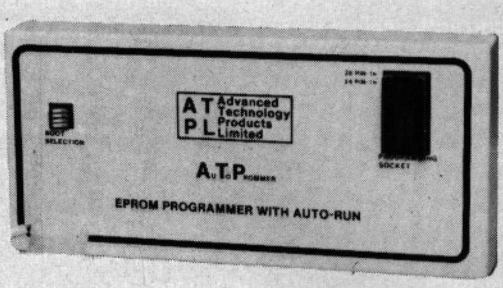

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Schools need all the help they can get

I AM reading the first issue of the BBC Micro User, and so far, for a newcomer to the micro like myself, it would appear to provide a refreshing easy to read and understand text for someone like myself and my family who want to make practical use of the computer as well as exploit its entertainment value.

I hope the magazine will provide information hitherto difficult to find under one cover without hours of research and study.

I note from your editorial that you are looking for views regarding the future contents of the magazine.

If possible could you please include a series on producing educational programs similar to those used in primary and middle schools and which are apparently not readily available at the moment.

As yet many schools have not been able to buy computers, and even those lucky enough to have one also generally have very restricted use by individual pupils.

I feel this would be particularly useful and would provide youngsters like mine, who are unlucky enough to go to a school without a computer, with a valuable stepping stone into the world of computer technology.

Another article which could be included is one on adapting programs to enable the games paddles to be used. Many programs, including Deathwatch, use the keyboard keys for control. On the face of it most programs would appear suitable for use with paddles.

A feature dealing with the basic steps and method required to amend the listing to cater for this would, I believe, be well received as well as save much wear and tear on the keyboard.

Other ideas: features presenting useful ideas for making use of the computer in the home as an aid to time saving and also to enhance traditional systems of information storage.

Articles on the presentation of this information to improve interest and make it easy to read and understand, would also be worth considering.

I look forward to receiving future issues of the magazine and hope that some of my suggestions can be incorporated. – **M.A. Godfrey, Gravesend.**

● Thanks for your suggestions. The use of the computer in education is a subject that we are deeply interested in, and we shall be regularly providing listings of educational programs for the pre-school child upwards. We've already got plenty in stock, but are always willing to accept more. So if any teachers or interested parents want to submit their programs or ideas to us we'd be only too pleased.

As for the topic of educational program design, articles on the subject tend to be rather woolly and not of much practical use. However, we shall be featuring a series on this subject which. we hope, will provide plenty of definite advice for the educational programmer.

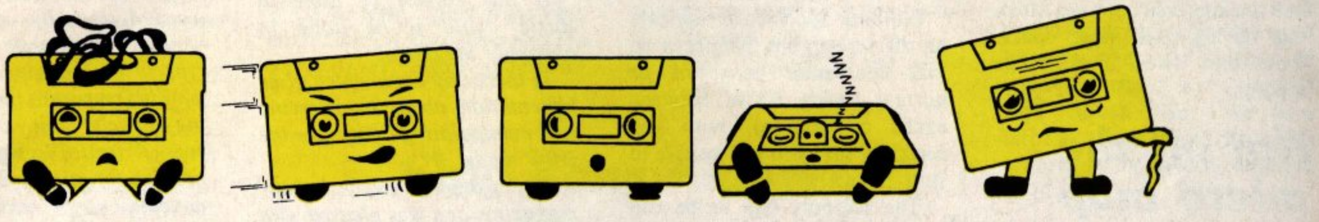
The point about the games paddle is well made. I think it would be impossible to write a comprehensive article on adapting programs already written (though I'm willing to be proved wrong). However, we do try to make sure that our contributors do bear in mind the great advantages the joystick has in many applications.

Greedy interfaces

I HAVE today purchased, read and enjoyed your magazine BBC Micro User. My main problem with my BBC machine has been loading cassettes, so I found the relevant article helpful.

My next problem is that, to

→



I READ with interest your article on Cassette Capers in your March issue.

As I am a computer engineer I was tempted to investigate further when my BBC micro suddenly failed to read in programs off cassette.

The problem turned out to be a faulty LM324N Quad operational amplifier, pin 10 (input from cassette) of which had incorrect DC bias on it. Replacing the chip cured the problem.

During the investigation I found that if I increased the level fed in far above the normal level required some programs would load, but my main concern was as to why the fault had occurred at all.

I can only guess as to what caused it but from my experience of interfaces I suggest the following as a probable cause: We share the tape recorder with our hi-fi and it is plugged and unplugged at regular intervals. I suspect doing this with the power ON both machines caused our fault to occur, there being no earth (which is normal) on the recorder.

Needless to say we have now ceased this practice.

More interesting was why some programs still loaded, and this investigation led me to discover a modification to the cassette input circuitry which is a 220nf capacitor between pin 14 and R90.

This blocks any small changes in the DC bias which may occur, and allows the final stage of the Op. Amp. to sit at the correct level for clipping the signal sent to the ULA. I do not know if you are aware of this modification, but from my experience it may be the answer to some cassette loading problems.

Obviously the leg nearest pin 14 of R90 should be lifted or the track cut to insert the capacitor. I spotted the modification on an Acorn drawing, so I am not aware of the official fitting instructions. Perhaps you could obtain them from Acorn.

I hope this information is useful to other BBC Micro users – **W.B.A., Ecclestone, Staffs.**

● Many thanks for your advice. It's always nice to be able to pass on readers' discoveries, particularly when they are as practical as yours.

MICROMAIL

From Page 97

overcome my first problem, I have invested in a disc drive system, but certain items of commercially produced software that did work on a BBC without disc interface will not now run, including some from Acorn! Can you help?

Finally, I would like to master graphics in Mode 7, including drawing lines. How about an article on this subject? – **R.Y. McNulty, Kettering, Northants.**

● Mode 7 articles are coming in a-plenty. As for the interface, unfortunately many dealers are fitting them without warning unsuspecting purchasers that they use up so much RAM as to leave programs that previously ran well short of space.

The answer is to set up one of the function keys as a downloader – we gave such a program in April's issue. You then LOAD (not CHAIN) the recalcitrant program from disc and press the appropriate function key to activate the downloader. This moves the program down in memory from where the disc loads it to the position it would have been in had the interface not been fitted, thus giving you more space. You can then run your program.

Not off the micro map

OUR school now has five BBC Micros and I bought (with my own money!) a copy of your magazine from a bookstall.

I was, therefore, quite disappointed to see that your article "Spreading the Micro Gospel in Education" made no mention of Scotland, either in the text or on the map.

It is supposed to be a national circulation magazine is it not? – **Hector MacSween, Glasgow.**

● Feminism last month, nationalism this! Apologies for omitting Scotland, but as the article was about the MEP, which doesn't function there, it would have been rather out of context.

Still, BBC Micro User aims to cover developmnts nationwide, and this will involve a look at the Scottish educational scene in the near future.

Cassette bug fix

I have a Model B BBC Micro version 0.1 and wish to use the cassette bug fix listed on page 39 of the March issue of BBC Micro User.

I am new to this type of program and wish to know whether, having run the program, I am then free to program normally, ie to use line numbers 10-180.

Initially, I assumed this program fix would only be run prior to saving or loading but Mike Cook suggests running it whenever the computer is powered up. – **R.G. Loveday, Woking, Surrey.**

● The idea of the program is to fix an error in the cassette filing system, to enable you to save and load programs or files reliably. All you have to do is to load the program and run it.

Nothing spectacular appears on the screen, but from then on you can enter programs as normal (using NEW between each, of course), with the certainty that you will be able to save them.

The fix only has to be run once, at switch-on. If, however, you switch off at any time, the BBC Micro will "forget" it and you will have to load it again.

Calling Mr Cooper

I AGREE with most of the letters in the last issue. Most of the magazine is easy to understand and provides basic knowledge of how the computer works.

There is one aspect of the magazine, however, which I feel is badly organised. This is the advertising. It would be a great help to the software buyer if:

1. All advertisers had to show a picture of their programs.

2. Any advertisers found to be untrustworthy would immediately be stopped from advertising.

I am sure these measures would give people more faith in mail order software.

Another idea would be to ask people to send in a list of the programs they think are good and then you could maybe compile a top ten so that we would know what was good and what was trash. – **Barry Cooper.**

● Mr Cooper also sent in an order for a cassette, but failed to include his address. Could he please write to us again?

Breezy beginning

YOUR first issue was definitely a spring breeze in the winter of BBC publications. It was refreshing and gave me lungfulls of joy!

I do have a quick but difficult query: Is there any way of passing different numeric arrays through the PROCEDURE call from the main routine to a certain procedure?

If this cannot be done in Basic could it be done in assembly language?

Is there any book which gives information about transferring and manipulating arrays for the BBC model B?

I thoroughly enjoyed your magazine, and was pleased with your exposition of available books. Keep advancing to a better spring for the BBC user. – **Fsa Al-Ramadhani, Ely, Cardiff.**

● Unfortunately there is no simple way of passing arrays in the fashion you describe. You'll have to stick to global variables, unless one of our readers has some devious ways of doing it.

That 6521

FIRST, my congratulations on your first issue – it is most encouraging.

However you have managed to confuse me on page 54. You talk about 6521 VIA; Acorn refer to 6522 VIA and someone else to 6522 PIA for this duty.

Can you possibly clarify this? – **R.L. Maltby, Farnham.**

● Sorry about that – it should have been 6522 VIA – *Mike Cook.*

Satisfied

I FOUND edition 1 of BBC Micro User absolutely superb. The format and content were exactly right. I have learnt and understood more from your edition than I have from six months of reading the other dross on the market.

As I have always believed in putting my money where my mouth is, I enclose my subscription for the next 12 months. Keep up the good work – **Tom Morrison, Liverpool.**

Digital dangers

CONGRATULATIONS on what looks a very promising magazine for the 'Beeb'. I admire your temerity in setting up a contest asking for listings. Presumably many can be weeded out by eye, but I wouldn't like to be the one to type in the remainder!

With respect to the tape reading article, one occasionally sees "digital" tape recommended for micros. This is magnetically very "hard" and requires a high-power bias to magnetise it – beyond the capacity of many domestic recorders.

When I received my recorder from Acorn I couldn't get a satisfactory load using the tape supplied.

I was about to return the recorder as faulty when I decided to check the recorded level on a machine with a VU meter. It was almost non-existent!

Substituting ordinary good quality audio tape has made tape operations so reliable that I often don't check-read smaller programs nowadays (provided *the O.1 OS bug-fix is in). I can't remember the last time I had a bad load.*

I have noticed one or two complaints about space bar action. My machine was very sticky when I first received it, but investigations showed that one of the plastic pedestals which link the ends of the bar to the bent wire "switcher" had succumbed to the GPO.

Replacement of this part has resulted in an action as good as, if not better than, the commercial electric typewriter on which I am writing this letter. (How about a competition for a printer?) – **K. Withey, Crowthorne, Berkshire.**

● The one who typed in the remainder didn't like it much either! But as it was Percival who started all the trouble, Percival it was who had to sort it out! He's stopped speaking to us. As for the printer competition, there's one on the way.

Matter of style

VISITING our newsagents recently, I was glad to find a new magazine devoted to the Beeb. You seem to have found a nice slot between the slightly snooty Acorn User and the ever so intense Beebug.

However, I would like to complain about the programming style of Deathwatch.

The program is fine once it is up and running and my son Ben (aged 11) has had every penny of the £1 I paid for your magazine back in enjoyment. But what a mess to de-bug and what arguments my son and I had when we were typing in the listing (he reads, I type).

Why not use the DEF PROC statements to divide up the text (or REMs even) instead of putting extra statements on the line?

Why not use real, meaningful names for the procedures (in lower case maybe)?

How about a few spaces and, although it isn't strictly necessary, a few THENs would have helped. Why use a colon before ELSE? And don't use 'I' as a variable, it's too like '1'.

I've seen worse examples but why not set a higher standard? Shapes, which I haven't tried yet, looks much more attractive and controlled. Let that be the standard.

Sorry to be so critical but you did ask.

Good luck! I'll be watching the newsagents for your next issue. – **J.R. Todd, Chester.**

● Programming style is the sort of subject that causes broken homes. Unfortunately, to program a fast-action Basic game of the high calibre of Deathwatch, which still fits into a 32k machine, style has in many cases to be sacrificed.

Shapes, a more sedate program, could afford to be somewhat extravagant in terms of execution time and memory – though I agree it's a pity that all programs can't be as nicely laid out (and as free from GOTOs).

Use of joysticks

I HAVE just purchased your first issue of BBC Micro User and was absolutely delighted with it.

Up to now, apart from club magazines, Acorn User was the only other BBC specialist publication and, as the saying goes, "Two heads are better than one."

I found the articles on software, monitors and particularly "Programming is easier than you think" very interesting and helpful, the programming article being especially easy to follow.

I feel this is very important as no doubt many people have purchased their first micro due to rave reviews but like myself are complete novices as regards how to use it.

I feel it would be helpful to advise in the software reviews when joysticks can be used as in Frogger and also whether using them is realistic.

To qualify my statement, Frogger allows joystick useage but, as you can move the frog East, North, West and South, you have to restore the stick to the exact central position to leave the Frog motionless.

You should try this. Unfortunately because the official BBC joystick is not spring-loaded, to automatically restore it to the central position the use of the joystick is virtually a non-starter as you can't watch screen and stick at the same time.

Unfortunately, several other games over-respond to joysticks in a similar way.

I look forward to all your coming issues and, if the standard is as high as that of the first, there is no doubt that I will buy them all. – **David Glew, Beckenham, Kent.**

● Odd you should mention Frogger – I've just tried with joysticks and watched my score plummet for much the same reasons. Mike Cook reckons he plays better with joysticks, though he's made his own. He describes how to do it in this month's instalment of the Beeb Bodybuilding Course.

Accent on business

WE are one of probably several thousand small businesses who have purchased the BBC Micro as a means of entering the world of the micro and with the intention of building up to useful and value-for-money hardware and systems.

We should, therefore, like to see in your publications as much guidance and business information material as you can cram into it. – **P.E. Hitchcock, Brighouse.**

● We see the BBC Micro, particularly with the advent of the second processor, as a serious proposition for the small businessman and intend to cover the subject in the pages of BBC Micro User. We have already commissioned a series of reviews of current business software.

Right approach

MANY thanks for BBC Micro User. To one fairly new to the BBC Micro and others to whom I have spoken, your "starting from scratch" approach is most helpful.

As drawing office manager of Wireless World I also find most of the contents extremely good – I would have puzzled over Fig. II Page 21 had the text not explained it. Congratulations again – **R.J. Goodman, Wandsworth.**

King Kong Klanger

APOLOGIES to all those who suffered from the errors in the King Kong listing – and congratulations to the many who worked them out. What is particularly galling is that we list directly from a working program to printer. King Kong, however, was listed on a new printer which produced the odd hiccup in the most well-hidden places – and on only one of our listings. Of course, that had to be the one that went through . . .

The two lines that contain errors should read:

```
180 VDU23,230,254,50,133,153,123,183,255,
    255,23,231,255,255,255,255,255,255,255,
    255,23,232,255,207,135,3,1,0,0,0,23,233,
    1,1,1,0,0,0,0,0,23,234,0,0,0,0,128,96,120,
    252,23,235,252,252,252,248,248,248,240,240

450 DEFPROChitcheck:IFY%<651AN
    DY%>599THENGOTO460ELSEIFY%
    <695ANDY%>650THEN480ELSEENDPROC
```

The errors do not occur, of course, on our cassette tape of programs from that issue.

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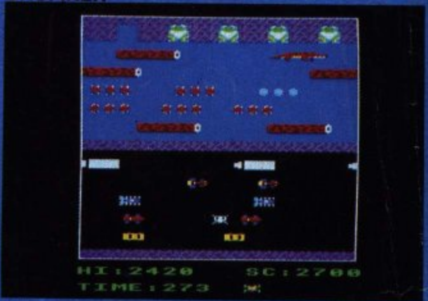

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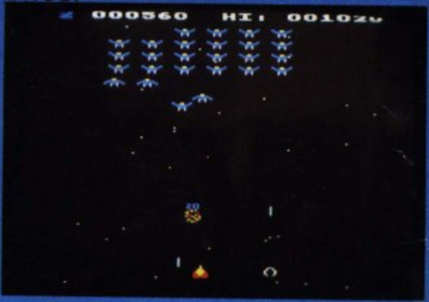

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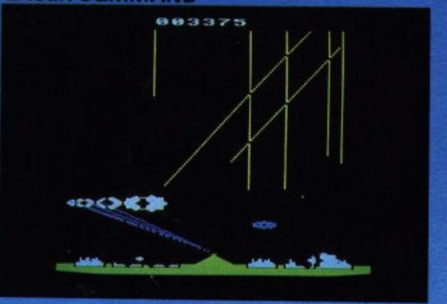

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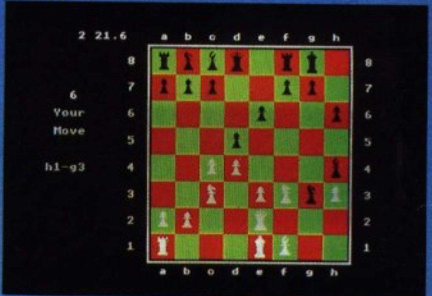

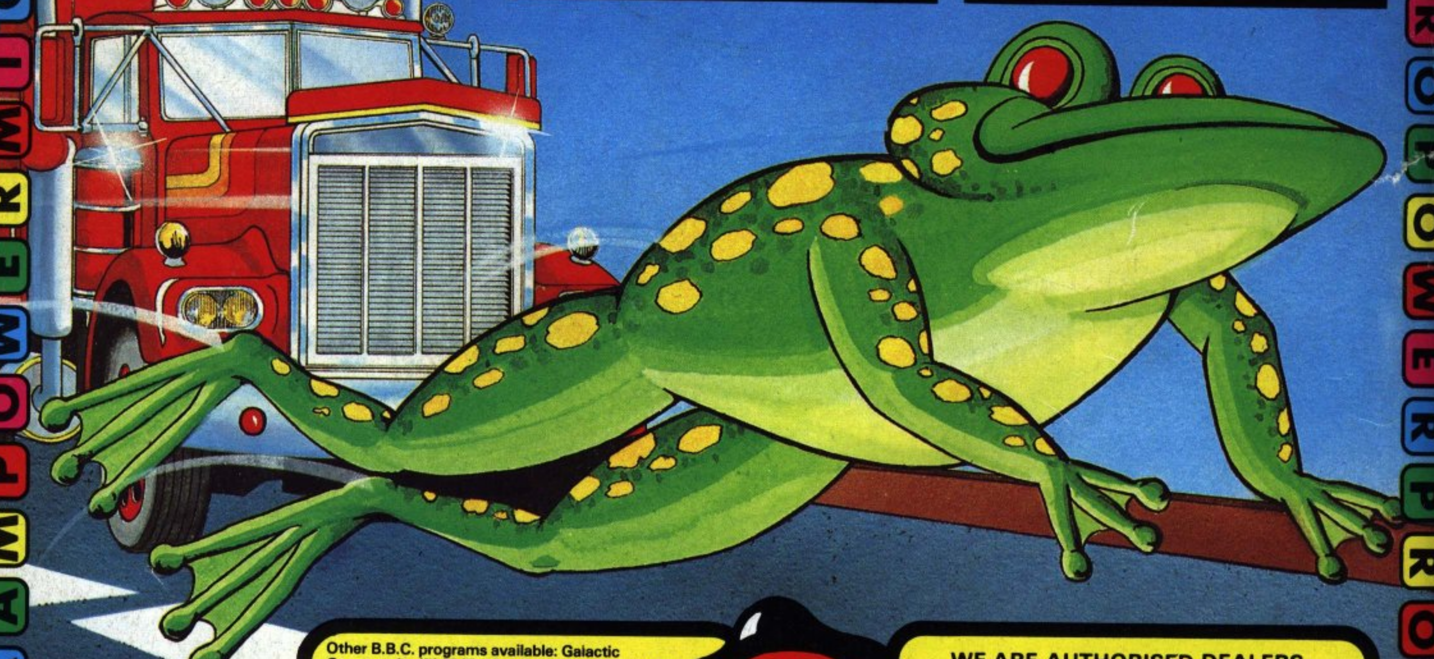

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